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THIS VOLUME DESCRIBES THE HEALTH AND SAFETY PROCEDURES WHICH WILL BE EMPLOYED AT RMA. THERE ARE SECTIONS ON THE FOLLOWING ELEMENTS:

1. PERSONNEL
2. HAZARD ASSESSMENT
3. TRAINING
4. PROTECTIVE CLOTHING AND EQUIPMENT
5. MONITORING PROCEDURES
6. DECONTAMINATION
7. EMERGENCY/CONTINGENCY PLANS.

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ROCKY MOUNTAIN ARSENAL
PROCEDURES MANUAL
TO THE
TECHNICAL PLAN
AUGUST 1986

EBASCO SERVICES INCORPORATED
R.L. STOLLAR AND ASSOCIATES
CALIFORNIA ANALYTICAL LABORATORIES, INC.
UBTL INC. TECHNOS INC. GERAGHTY & MILLER, INC.

DAAK11-84-D-0017

PREPARED FOR

PROGRAM MANAGER'S
OFFICE FOR
ROCKY MOUNTAIN ARSENAL CLEANUP

ROCKY MOUNTAIN ARSENAL

PROCEDURES MANUAL

TO THE

TECHNICAL PLAN

AUGUST 1986

CONTRACT NO. DAAK11-84-D-0017

VOLUME III: PROJECT HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

1.0 GENERAL INFORMATION

This plan* has been prepared in conformance with the Ebasco Health and Safety Program for Hazardous Waste Sites. It addresses all those activities associated with the Environmental Program for the Rocky Mountain Arsenal (RMA) Project and will be implemented during all site investigations and related onsite work. Compliance with this Health and Safety Plan (HASP) is required of all workers and third parties who enter this site. Assistance in implementing this Plan can be obtained from the Project Health and Safety Officer.

SITE ROCKY MOUNTAIN ARSENAL

PLAN DATE January 1986 (Revision)

	PROJECT MANAGER	PROJECT HEALTH AND SAFETY OFFICER
Name	J. Silvey	L. Niemiec
Phone	(714) 662-4048	(303) 998-2202

1.1 Emergency Phone Numbers

Emergency phone numbers will be posted in the Command Post onsite during all field operations. Contingency guidelines for emergency situations are provided in Section 14.0.

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* This plan is an intermediate step which addresses the specific requirements of site reconnaissance as well as generally addressing planned work activities. The content of the HASP may change or undergo revision based upon results of reconnaissance/survey operations or upon information made available when the specific work programs have been developed. It must also be revised when deficiencies are identified or when new operations, previously not addressed in this HASP, are planned. The associated work programs and technical plans will be reviewed by the Health and Safety (H&S) staff and any modifications indicated or proposed will only be implemented based upon consultation and approval of the Project H&S Officer and the Project Manager.

EMERGENCY PHONE NUMBERS (Cont'd)

RMA CAICO (Capt. Rayburn)	(303) 289-0141
RMA Security Dept.	(303) 289-0369
RMA Fire Dept.	(303) 289-0223/(303) 289-0192
RMA Tech Escort (Sgt. Lott)	(303) 289-0152
RMA Safety Office (A. Harris)	(303) 289-0338
RMA Facilities Operations (J. Greene)	(303) 289-0166

Ambulance Service

RMA Fire Dept.	(303) 289-0223
Reeds Service	(303) 758-1333
Airlife Helicopter	(303) 360-3250
Presbyterian Aurora Hospital	(303) 360-3133
Dr. Thomas Blanchard	(303) 288-2615
Rose Medical Center	(303) 298-0891
PMO Contract Office Rep. (K. Blose)	(301) 671-3530
Planning Consultant (R. Stollar)	(714) 662-4120
Technical Manager - Remedial Investigation (R. LO)	(303) 988-2202
Technical Manager - Feasibility Studies (J. Keithley)	(303) 988-2202
Task 2 Manager (K. Knirsch)	(303) 988-2202
Task 7 Manager (R. Lytle)	(303) 988-2202
Task 10 Manager (D. Gabel)	(303) 988-2202
Task 11 Manager (G. Bradbeer)	(303) 623-8080
Task 12 Manager (R. Lytle)	(303) 988-2202
Task 15 Manager (K. Mahmood)	(303) 988-2202
Health & Safety Officer (L. Niemiec)	(303) 998-2202
National Response Center	(800) 424-8802
Task 17 Manager (A. Sarkar)	(714) 662-4036
Task 26 Manager (D. Gabel)	(303) 988-2202
Task 27 Manager (L. Morlan)	(206) 451-4582

EMERGENCY PHONE NUMBERS (Cont'd)

Task 34 Manager (J. Butts)	(206) 451-4614
Task 38 Manager (P. Chiaro)	(303) 988-2202
Poison Control Center	(800) 822-9761
Offsite Emergency Services	911
Ebasco Command Post	(303) 877-2848
Ebasco Support Trailer	(303) 287-3714
Ebasco Lakewood Office	(303) 988-2202

2.0 HEALTH AND SAFETY PERSONNEL

2.1 Health and Safety Personnel Designations

The following briefly describes the health and safety designations and general responsibilities which will be employed for the RMA Project. While these titles are different than those employed in the Ebasco Corporate Health and Safety Program for Hazardous Waste Sites, the responsibilities are consistent with analogous titles and responsibilities in the Corporate Program. The title changes have been implemented in order to accommodate RMA Project needs and requirements.

2.2 Project Health and Safety Officer

The Project Health and Safety (H&S) Officer has overall project responsibility for development and implementation of this Health and Safety Plan (HASP) and conformance with RMA requirements. He will also be the primary contact for matters related to health and safety between the Army and Ebasco's program. The Project Health and Safety Officer will be responsible for performing field audits of all health and safety related operations to check conformance with the procedures described herein and with the Corporate Program. This will be performed at a frequency of once per month or as required during the conduct of field operations. He will also be consulted when any changes to this plan or modification of any procedures are required or requested or when any new activities are proposed. The Project H&S Officer will be responsible for the development of any new safety protocols and procedures necessary for new field operations and will also be responsible for the resolution of any outstanding safety issues which arise during the conduct of site work. When required, he will also be responsible for revisions to this HASP or the preparation of amendments for new operations. All health and safety related duties and responsibilities will be assigned only to qualified individuals by

the Project H&S Officer. Authorization for personnel to perform work onsite, i.e., relative to medical exams and training, must be cleared through him. The Project Health and Safety Officer will maintain a project record which includes all information relative to site accidents, injuries or incidents.

2.3 Health and Safety Supervisor

The Health and Safety Supervisor will be present onsite during the conduct of all field operations and will be responsible for all health and safety activities and the delegation of duties to the H&S staff in the field. He will be responsible for implementation of the HASP, assuring that appropriate personnel protective equipment is utilized relative to the hazard which may be encountered, verifying that communication systems are inplace, monitoring conformance with safety and emergency procedures, providing for downrange team backup, giving daily safety briefings, seeing that safety equipment is maintained and conducting safety drills and exercises. He may direct or participate in downrange activities as appropriate and when this does not interfere with his primary responsibility as H&S Supervisor. He will also be responsible for the set-up and execution of decontamination procedures. In case of an accident the H&S Supervisor will fill out the US Army Accident/Injury Report (DA 285 and DA 1051). The report should then be sent to the RMA Safety Officer, Project H&S Officer and RMA CAICO. When a situation occurs which could have resulted in an accident, injury, or loss or damage to property the H&S Supervisor will contact the Project H&S Officer for the required documentation and reporting procedures. The Health and Safety Supervisor has stop-work authorization which he will execute upon his determination of an imminent safety hazard or potentially dangerous situations, e.g., weather conditions, where this action is appropriate and after consultation with the H&S Officer. Clearance to proceed with work following such an authorization will be issued by him. The H&S Supervisor will initiate and execute all contact with RMA facilities

and personnel when this action is appropriate. The H&S Supervisor will provide the Fire Department with information regarding the planned operations, PPE, hazards, personnel, etc., for the intended operations. He will also identify the location of planned operations for that day on a map provided by the Fire Department.

2.4 Health and Safety Field Officer(s)

The Health and Safety Field Officer will be the downrange person who accompanies field sampling teams and will report to the H&S Supervisor. His primary responsibility is to provide monitoring to ensure the safe conduct of field operations. He will have access to continuous communications with the Command Post. The number of these personnel will be dependent upon the number of downrange operations occurring simultaneously and individual assignments will be made by the Health and Safety Supervisor. H&S Field Officers will also be responsible for ensuring that all safety practices are utilized by downrange teams and that during emergency situations appropriate procedures are immediately and effectively initiated. He will also be responsible for the control of specific field operations and all related activities such as personnel field decontamination, monitoring of worker heat or cold stress, distribution of safety equipment, and conformance with all other procedures established by the H&S Supervisor. The H&S Officer has stop work authorization in case of an imminent safety hazard or potentially dangerous situation.

2.5 Air Monitoring Specialist

The Air Monitoring Specialist will perform all required air monitoring procedures necessary to support specific activities identified by the Project H&S Officer. These activities will include operations where special problems exist, extensive instrumentation is required or particularly difficult operations are planned. He will provide consultation to the project team on an as needed basis where such services are necessary to ensure that appropriate monitoring,

calibration, and maintenance procedures are employed. The Air Monitoring Specialist will initially be part of the H&S Reconnaissance team and will provide operational set-up for instrumentation for future work at RMA. This will include specification as to type of instrumentation and procedures to be employed for its proper use.

2.6 Health and Safety and Safety Technician(s)

The Health and Safety Technician will report to the H&S Supervisor and will receive his/her specific duties from him. The H&S Technician will be responsible for the set up of the main decontamination facility and the maintenance of all associated equipment, in particular the decontamination trailer. The H&S Technician will maintain the inventory of safety equipment and will be responsible for its distribution. When appropriate, the H&S Technician will provide monitoring of heat stress with the WBGT apparatus and assist in safety monitoring where appropriate. The H&S Technician will also provide a communication link and can serve as an emergency backup as appropriate.

3.0 SITE HISTORY AND PHYSICAL DESCRIPTION

3.1 Location

The Rocky Mountain Arsenal (RMA) is located in Adams County, Colorado, 10 miles northeast of the City of Denver and directly north of the Stapleton International Airport (see Figure 3.1-1). The site is located at 39°45'N latitude and 104°52'W longitude and has an elevation of approximately 5,200 feet MSL. The site occupies over 17,000 acres and is bordered by lands utilized for a mix of agricultural, light industrial, manufacturing and residential purposes. The RMA property is divided into one mile square sections. The sections of principal interest at this time are Sections 1 and 2 which are referred to as the South Plants Area (see Figure 3.1-2). The South Plants Area is bounded on the north by December 7th Avenue, on the south by Sixth Avenue, on the west by C Street and on the east by E Street. Entrance to the South Plants Area is made from December 7th Avenue. Future tasks may include other sections. The main base for site operations is located in the south plants area at a support trailer area located adjacent to December 7th Ave in Section 1.

3.2 Description

The Rocky Mountain Arsenal (RMA) encompasses 27 square miles and includes facilities formerly employed in the manufacture, testing and packaging of various chemical agents and commercial products. The site is generally open prairie, except Sections 1 and 2 comprising the South Plants Area, which consists of over 300 buildings formerly housing various commercial chemical manufacturing process and laboratory facilities as well as military production and storage facilities. In addition, the area has many storage tanks and vessels as well as extensive piping systems, which, along with the buildings, are in various states of condition ranging from structurally sound to

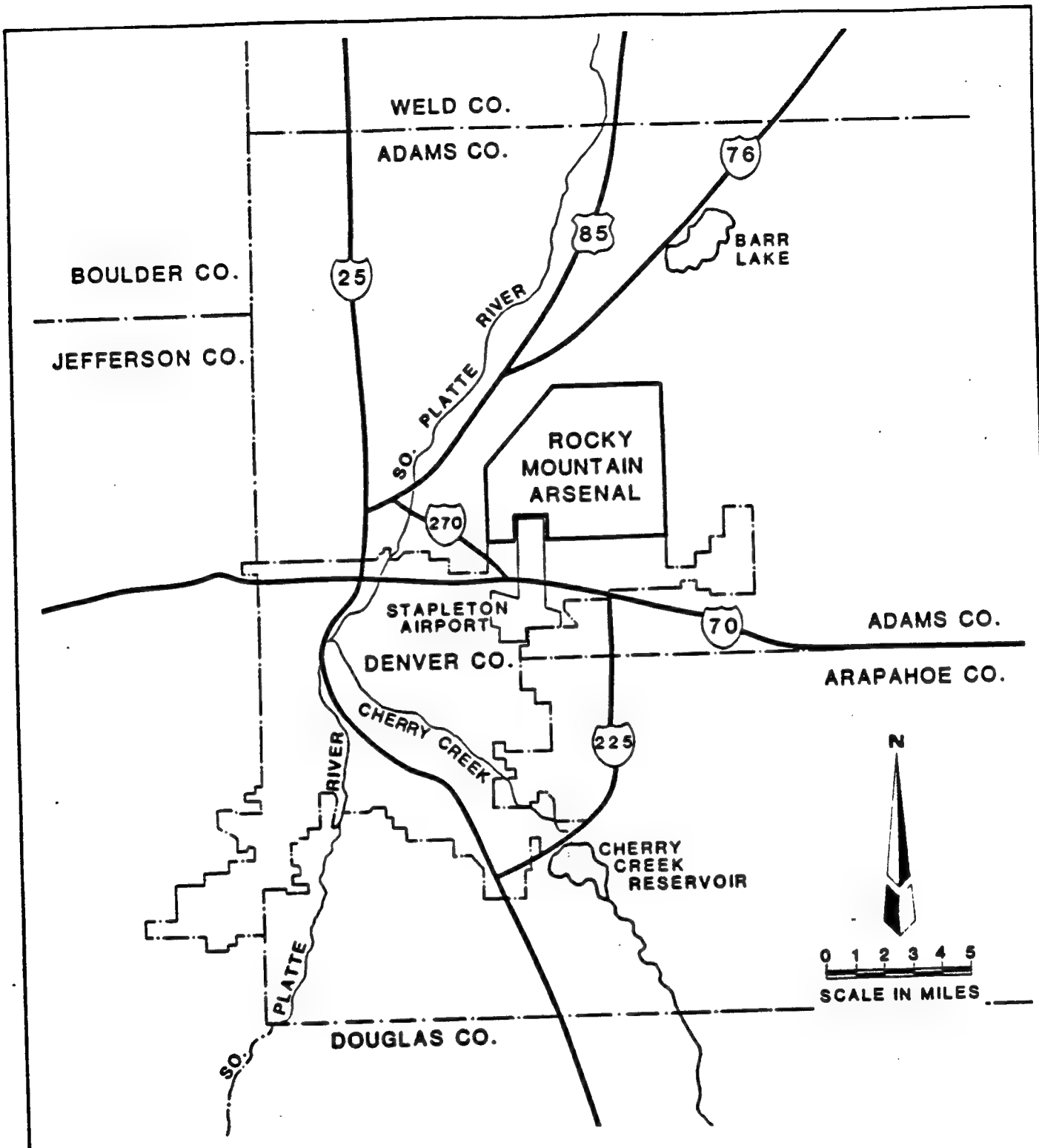


Figure 3.1-1
MAP OF RMA AND DENVER VICINITY

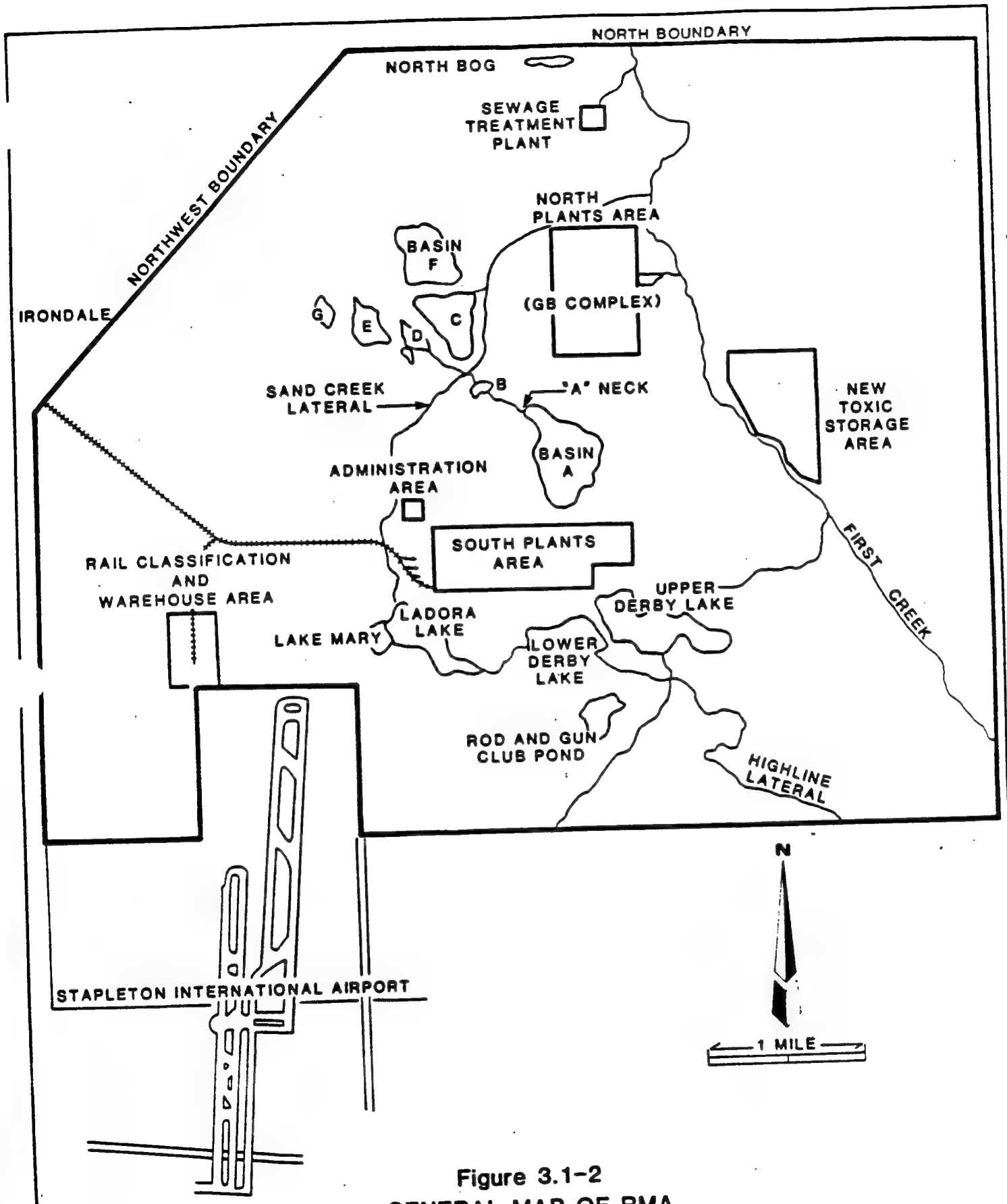


Figure 3.1-2
GENERAL MAP OF RMA

SOURCE: RMA CONTAMINATION CONTROL PROGRAM MANAGEMENT TEAM, 1983

deteriorated. Major roadways are generally paved; and fire hydrants and fire phones are located throughout the South Plants Area. Numerous railroad tracks cross through the site generally in an east-west direction. Some facilities are presently in use although most are on standby status or are abandoned. Also found onsite are numerous pits, ponds, lakes, and basins used for the treatment and disposal of waste products. There are four lakes in Sections 1 and 2 of importance in this project. These are Lake Mary, Ladora Lake, and Upper and Lower Derby Lakes (see Figure 3.1-2).

Groundwater flow occurs in both alluvial and bedrock aquifers and is part of one continuous hydrologic system. Regional groundwater flow is from the south to the north and northwest toward a discharge area in the South Platte River Valley. Locally, a 30-foot high mound in the water table has been inferred beneath the South Plants Area. This mound has been attributed to leakage of cooling water from piping in the South Plants Area.

3.3 History

The property occupied by Rocky Mountain Arsenal (RMA) was purchased by the government in 1942; prior to this the land was primarily used for agriculture. The Rocky Mountain Arsenal was established in the spring of 1942 and was essentially a manufacturing facility. Its first production of mustard was in January 1, 1943. During World War II, the Arsenal's basic mission was the manufacture of mustard, lewisite, and incendiary bombs. During this period, arsenous chloride and chlorine gas were also produced. In the period 1945-1950, the Arsenal distilled all available stocks of levinstein mustard and demilitarized several million rounds of mustard-filled shells.

In 1947, part of the South Plants facilities were leased to the Colorado Fuel and Iron Corporation (CF&I) for chemical manufacturing. CFI manufactured chlorinated benzenes and DDT. Julius Hyman Company assumed

the lease in 1949 and used the facilities for the production of insecticides. In 1952, the Shell Chemical Company (SCC) took over the operation of the insecticide facilities. SCC manufactured both chlorinated organic and organophosphorous insecticides and herbicides. They leased approximately 300,000 square feet of manufacturing buildings and warehouses; they also operated the electrical power and steam generation utilities on the post.

Industrial waste effluents generated at RMA were initially discharged into an unlined Basin just north of the original plant area, referred to as Basin A. This Basin received the industrial wastes discharged from all operating plants of the Government and lessees. For disposal of the additional manufacturing waste from the GB plant, the dike impounding water in Lake A was raised five feet.

During the Vietnam Conflict, operations at the Arsenal included demil of CK (cyanogen chloride) and CG (phosgene) bombs which has been filled during World War II. After emptying, these bombs were shipped out for high-explosive filling. In addition, the Arsenal had a crash program for two years producing munitions for the Aerial Mine Program. The Arsenal also demilled phosgene-filled mortars, and Mustard-filled shells, which were modified for HE and WP filling.

Since 1970, RMA has primarily been engaged in the disposal of chemical warfare materials. This disposal included the incineration of anti-crop agent (TX), mustard agent (H, HD), explosive components, and the destruction of GB agent by caustic neutralization. Recent programs (circa 1980) included transfer of Weteye munitions to another Army facility, both destruction and sale of phosgene (carbonyl chloride), and incineration of obsolete Chemical Agent Identification Sets (CAIS).

Although the Arsenal boundary has changed configuration during the years, Sections 1 and 2 boundaries have remained unchanged; however, many structures have been added, including buildings, tanks and utilities.

The hydrazine blending facility operated by RMA for the Air Force began operations in 1962. The facility was built for the blending of hydrazine and unsymmetrical dimethyl hydrazine rocket fuels. RMA closed the facility on May 5, 1982 after a study by OSHA Region VIII office which indicated problems at several operations. With the Air Force beginning downloading operations of Titan II missiles, the need for hydrazine blended fuels was reduced so that RMA and ARRCOM could close down the hydrazine blending activities by June 1983.

In a study, conducted by Brook Air Force Base in October-November 1978, low concentrations of NDMA were found at several locations in the plant. RMA recommended the use of self-contained breathing apparatus in the blending area, tank farms during inventory, and drumming area during operations. A 1980 study by AEHA found NDMA throughout the facility and recommended SCBA's for all entries to the facility during operation and up to 24 hours after operations. Additionally, RMA adopted a 16 hour wait period between operations. After a survey conducted by OSHA Region VIII in January-March 1982, problems were found with the operations at certain parts of the facility. An abatement plan was drawn up by RMA and supported by the Air Force and AEHA which considered: facility cleanup and decontamination, facility modifications to eliminate NDMA sources, fuel system modifications and priority bulk transfer or blending operations, and drum filling and cleaning and miscellaneous.

4.0 SITE-RELATED INCIDENTS, COMPLAINTS, ACTIONS

It is instructive to review some of the incidents, accidents or spills that have occurred in the South Plants Area in order to help assess potential hazards that may exist here or in other areas. Examples of several of these are provided below and included in Appendix B for review purposes only. This information should not be taken as all inclusive since it reflects only that information available for incorporation in this HASP during its development.

1. Numerous chemical spills have occurred in the South Plant Area since operations began at RMA. The types of spills included leaking sewers, seepage to ditches, spills on ground, and spills in buildings. Spill quantities ranged from 55 to 100,000 gallons and included insecticides, soil fumigants, still bottoms, fuel oil, acids, and reagents. A partial listing of spills due to operation by lessee of the South Plants Area is presented in Appendix B.

2. In May 74, diisopropylmethylphosphonate (DIMP) and dicyclopentadiene (DCPD) were detected in surface water draining from a marshy bog on the northern boundary of the Arsenal. Later in the year, the Colorado Department of Health (CDH) detected DIMP in a well near the City of Brighton, north of the Arsenal. This led to the issuance of three Cease and Desist Orders on April 1, 1975 by the CDH. As a result of the Cease and Desist Orders, a program of contamination control was established and placed under the direction of the Project Manager for Chemical Demilitarization and Installation Restoration (PM CDIR) and later, the US Army Toxic and Hazardous Materials Agency (USATHAMA). Under this program, studies were initiated to determine the extent of contamination on the Arsenal and to develop contamination control systems for contaminants migrating across the boundaries of RMA.

3. In 1964 an incident occurred resulting in contamination of Upper and Lower Derby and Ladora Lakes with pesticides, aldrin and dieldrin. To clean the pesticide contamination, the lakes were drained and the bottom sludge scraped out of the lakes and buried in Sections 11 and 12.

5.0 WASTE DESCRIPTION/CHARACTERIZATION

5.1 Waste Types

Table 5.1-1 provides information on chemical and toxicological characteristics of selected hazardous substances that may be present at RMA. When there is a need for additional toxicity data or other information on specific chemicals encountered onsite, Ebasco will access on-line chemical data base systems including Hazardline, Registry of Toxic Effects of Chemical Substances (RTECS), Oil and Hazardous Materials Technical Assistance System (OHMTADS) etc. Information regarding exposure limits and standards for personnel exposed to Army chemical agents has been requested and is provided in Table 5.1-2. Additional information will be included when it is made available. When issued, these will also be included as a reference source. Appendix C presents a list of chemical compounds known to exist, have been used, or were produced or handled at RMA.

1. WASTE TYPES: Liquid X Solid X Sludge X Gas X
   Semi-solid X

2. CHARACTERISTICS: Corrosive X Flammable X Radioactive _____
   Toxic X Volatile X Reactive X Inert X
   Explosive _____

3. CONTAINMENT: Vat X Pipe X Tank X
   Lake X Lagoon X Other UNKNOWN
   Lab Pack ____ Drum ____ Process Vessel X
   Tank Car ____

TABLE 5.1-1

HAZARDOUS WASTE CHARACTERISTICS[1,2]

Compound	Class	Toxicity[3]	Persistence[4]	Ignitability	Reactivity[5]	Corrosivity	Exposure Route[6]
Phosgene	Choking Agent	+	-	-	-	+[7]	I
Sarin	Nerve Agent	+	-	-	-	-	S,I
Hydrogen cyanide	Blood Agent	+	-	+	-	-	I
Mustard	Blister Agent	+	+	-	-	+	S
White phosphorus	Spontaneous Flammable	+	-	+	+	-	S
Mercury	Heavy Metal	+	+	-	-	-	I
Aldrin	Organochlorine Insecticide	+	+	-	-	-	S
Parathion	Organophosphate Insecticide	+	-	-	+	-	S
Carbon tetrachloride	Halogenated Hydrocarbon Solvent	+	+	-	-	-	I
Benzene	Aromatic Hydrocarbon Solvent	+	-	+	-	-	I
Hydrochloric acid	Miscellaneous (Corrosive)	+	-	-	-	+	I
Hydrazine	Reducing Agent	+	+	+	+	+	S
Nitrosodimethylamine	Nitrosamine	+	+	-	-	-	S,I

1) These ratings are presented as examples of individual compounds that may be encountered at RMA. They do not apply to all chemicals within a given class.

2) For each category, when available from RCRA or CERCLA hazardous wastes/substances lists, - = none (0) or low (1) level, + = moderate (2) or high (3) level. Otherwise based on professional judgement of available literature.

3) Toxicity = overall assessment of acute/chronic, local/systemic effects.

4) Persistence = biodegradability.

5) Reactivity = stability of compound under normal conditions, not a measure of incompatibility.

6) I = inhalation, S = skin (dermal) absorption. Route of exposure is the inferred primary route of entry during non-intrusive activities in the buildings. Since many compounds at sufficient concentrations present a hazard by multiple routes of entry, confined spaces or unknown situations necessitate protection against all routes.

7) Phosgene is corrosive when moist.

TABLE 5.1-2

SELECTED CHEMICAL AGENT TWAs

Chemical*a Agent	Army TWAs	Other Source TLV/TWAs
1) Mustard	(a) 0.4 mg/m^3 Maximum Exposure Level (b) 0.01 mg/m^3 for single 3 Hour Period (c) 0.005 mg/m^3 for single 8 Hour Period (d) 0.003 mg/m^3 for any 8 Hour Exposure Period Averaged Over 5 or More Consecutive Work Days	
2) H (Levinstein Mustard)	0.003 mg/m^3	
3) HD (Distilled Mustard)	0.003 mg/m^3	
4) Lewisite (L)	0.0001 mg/m^3 (ceiling)	
5) DCPD	30 mg/m^3	
6) Phosgene (carbonyl chloride)	0.4 mg/m^3	(a) 0.1 ppm (OSHA) (b) 0.1 ppm (ACGIH) (c) 0.1 ppm (NIOSH) (d) 0.2 ppm (NIOSH 15 minute ceiling)
7) Cyanogen Chloride (CK)	0.6 mg/m^3 (ceiling)	0.3 mg/m^3 (ACGIH)
8) White Phosphorus		(a) 0.1 mg/m^3 (OSHA) (b) 0.1 mg/m^3 (ACGIH)
9) Soman (GD)	0.0003 mg/m^3	
10) Sarin (GB)	0.0001 mg/m^3	
11) Hydrazine	-	0.1 ppm (ACGIH) 0.04 mg/m^3 (NIOSH 2 hr ceiling)
12) Monomethyl Hydrazine	-	0.2 ppm (ACGIH) 0.08 mg/m^3 (NIOSH 2 hr ceiling)
13) Unsymmetrical Dimethyl Hydrazine	-	0.5 ppm (ACGIH) 0.15 mg/m^3 (NIOSH 2 hr ceiling)
14) N-Nitrosodimethylamine	-	No Exposure

*a Other Chemical Agents will be listed as more information is made available.

2378E

6.0 HAZARD ASSESSMENT

6.1 General

The overall site hazard assessment is extremely variable and is entirely location and operation dependent. This judgement is based upon a review of the information made available at RMA (Rocky Mountain Arsenal). The hazard assessment of each location (e.g., building, drilling site, etc.) will be based on historical information, available data, and the results of any monitoring data. Pesticides, surety materials, unexploded ordnance (UXO), and a variety of product component materials may be present at many of the areas designated for investigation.

Groundwater samples previously analyzed were shown to contain pesticides, aromatic solvents and a variety of other chemicals. Soils throughout the site where spills have occurred, especially those near the lakes (i.e., upper and lower Derby Lakes, Ladora Lake and Lake Mary) and waste storage areas, are assumed to be contaminated. The structural integrity of onsite buildings to be sampled is unknown and may pose a hazard in addition to the confined space and restricted access problems which may be encountered in the buildings. Pipelines which require sampling may contain contaminated residues, liquids or gases which must be identified, located and sampled. In addition, existing manholes, tanks and vats may contain sludges, liquids or residues which must be sampled and may also contain unknown concentrations of toxic gases. These confined spaces present an additional hazard to be addressed and an extra level of safety will need to be applied. Section 8.0 identifies levels of personnel protection to be employed during the conduct of site work.

Numerous chemicals are known to have been used or manufactured in operations at RMA (see Appendix C). The spectrum of deleterious effects presented by exposure to these chemicals is extremely wide.

However, classifying compounds by their use, physiological action, or physical state provides a useful way to focus on toxic effects that will dictate the appropriate levels of protection and more clearly define the potential hazards. The following classification system will be used here: chemical warfare agents, pesticides, organic solvents, metals, and miscellaneous hazardous chemicals. Examples of compounds suspected of being commonly present at the site will be used to provide a general hazard assessment based on the relevant exposure characteristics (e.g., route of exposure, duration of exposure), the types of adverse effects that could occur (local vs. systemic effects, reversible vs. irreversible effects), as well as additional chemical characteristics of safety concern (flammability, reactivity, persistence). It is important to note, however, that given the wide variety of toxic effects produced even within a particular class, generalizations are useful only in providing an overview of health hazards that may result from exposure to specific chemicals.

6.2 Chemical Warfare Agents

Most of the following military chemical agents are classified by their physiological action.

6.2.1 Choking Agents

Phosgene (carbonyl chloride) is an example of a "choking agent" known to have been associated with operations at the site. Usually phosgene is present as a gas (except at below 8°C (46°F), when it is a liquid). The primary route of exposure is, therefore, by inhalation. Choking agents are acute toxicants that produce local effects (i.e., at the site of entry into the body). Phosgene exerts its toxic effects in the lungs and results in the accumulation of fluid that prevents oxygen uptake resulting in suffocation. Even relatively low concentrations of phosgene that are not very irritating may result in a toxic dose, since this compound causes delayed toxicological effects (several hours after exposure).

Phosgene and other choking agents are gaseous toxic chemical agents that, if present, would require the highest level of respiratory protection due to the extremely dangerous nature of these compounds. Due to the high volatility of phosgene, it is doubtful that residual phosgene remains in buildings. However, confined spaces should be treated with extra caution.

6.2.2 Nerve Agents

"Nerve agents" are extremely toxic compounds that rapidly affect muscular coordination. Sarin is an example of a nerve agent known to have been associated with operations at the site. (Another nerve agent, VX, is very similar to Sarin but is less volatile.) Sarin is present as a liquid; exposure to its vapor also presents an extreme hazard. Specifically, nerve agent vapors may be inhaled as well as rapidly absorbed through the skin and eyes. Dermal uptake of nerve agents in liquid form is also very rapid. A lethal dose of sarin will act extremely rapidly on the autonomic nervous system and result in death immediately or delayed for up to 2 hours. Sarin and other nerve agents are considered among the most toxic chemicals known which dictates the highest degree of both respiratory and skin protection when these compounds are believed to be present.

6.2.3 Blood Agents

"Blood agents" are compounds that generally are inhaled, enter the circulatory system, and interfere with blood to tissue oxygen transfer. Cyanogen chloride and hydrogen cyanide are blood agents with similar properties and mechanisms of action. Blood agents are typically highly volatile liquids. In addition, acute exposure to toxic doses results in very rapid physiological responses (e.g., lethal doses cause death within 15 minutes). While the nature of these compounds dictates the highest level of personnel respiratory protection when present, their high volatility makes onsite contamination in unconfined spaces unlikely.

6.2.4 Blister Agents

"Blister agents" are relatively low volatility compounds that burn the skin, eyes, and lungs. Chemicals in this class include mustard (Levinstein and distilled), and arsenicals (i.e., a group of compounds with arsenic as the central atom) such as lewisite. These compounds (as liquids or vapors) poison any part of the body that is exposed.

Both agents exhibit delayed toxic effects, i.e., blisters form hours after exposure. Mustard and lewisite exposures result in toxic responses at the site of action; lewisite also acts as a systemic toxicant when absorbed by tissues. In addition, mustard and lewisite are suspected and recognized carcinogens, respectively. The blister agents are extremely toxic compounds that cause severe burns at the site of contact even at very low concentrations. Consequently, the presence of compounds such as mustard and lewisite would necessitate a high degree of dermal protection and respiratory protection.

Another hazardous compound known to have been associated with operations at the site is white phosphorus. White phosphorus is a spontaneous flammable solid, i.e., particles will burn when exposed to air. Although white phosphorus vapors are toxic, the primary safety concern would be the spontaneous combustion of this material resulting in a fire hazard. Since it ignites spontaneously, white phosphorus contamination would be in airtight, confined spaces. Consequently, in areas where white phosphorus contamination is suspected, appropriate measures would be taken to protect against burning particles (e.g., shielding, flame-proof clothing, avoidance, etc.).

6.3 Metals

Numerous metals were associated with activities at RMA. These non-biodegradable compounds can accumulate in the environment. The most likely route of exposure at the site is by inhalation of

airborne metal particles. A wide range of toxic effects may occur from exposure of the various metals. Due to heavy use and/or spills, the most likely heavy metals that would be encountered at the site are arsenic, mercury and lead.

Acute toxicity from arsenic exposure usually occurs via ingestion. Chronic arsenic poisoning by inhalation is of more concern for the safety of sampling personnel. A variety of systemic effects may occur from chronic exposure to arsenic compounds including damage to the liver, kidneys, blood, and nervous system. Arsenic has been implicated as a human carcinogen. The blister agent lewisite discussed above is an arsenic compound. Arsenic trichloride is another arsenical contaminant that may be present at the site.

Mercury exposure causes a wide range of acute and chronic effects. The form of mercury (elemental, inorganic, or organic) influences the toxic responses. For example, chronic exposure to inorganic mercury usually results in renal toxicity while elemental mercury affects the central nervous system. Due to the high vapor pressure of elemental mercury (which may be present onsite), inhalation would be the most important route of exposure in industrial exposures. In general, although mercury compounds may affect a number of different organs and systems, the most common toxic effects are on the central nervous system.

Like arsenic and mercury, lead is a heavy metal that produces toxic effects on a number of different organs or tissues. The most common exposure route of lead compound is by inhalation of the dusts or vapors. In addition, organic lead compounds may also be absorbed through the skin. Lead is a suspected lung and kidney carcinogen. At RMA, a primary lead contaminant may be lead azide. Unlike many other lead compounds, the hazard associated with lead azide is due more to the explosion potential rather than systemic toxicity. This is a very dangerous compound since shock and heat will cause explosions.

It is clear that metals present a variety of hazards to an exposed worker. However, in general the inhalation of metals (particles, vapors, fumes, etc.) present the most common absorption route. Consequently, respirators should be selected to prevent exposure to these toxic compounds.

6.4 Pesticides

Production of numerous types of pesticides has presumably resulted in contamination at RMA. Considering the diversity of chemical and biological properties of pesticides, generalizations about this group of toxicants are difficult. Compounds may range from highly toxic to essentially non-toxic. Mechanisms and sites of action are also variable. Many pesticides are suspected of possessing carcinogenic potential.

Organophosphate insecticides that may be encountered include parathion and malathion, the latter being considerably less toxic. The systemic effects of organophosphate pesticides occur when the enzyme cholinesterase is inhibited which causes acetylcholine levels to increase. Local effects may occur at the site of exposure (e.g., blurred vision) although the high degree of acute toxicity results from systemic absorption and distribution.

Operations at the site involved a number of different organochlorine insecticides such as DDT, chlordane, toxaphene, aldrin, dieldrin, endrin and lindane. In general, compared to organophosphate pesticides, organochlorine compounds are often regarded as less toxic on an acute basis but more toxic from chronic exposure. Both classes consist of many neurotoxic agents, but they act by different mechanisms. Organochlorine insecticides are usually very persistent in the environment and also accumulate in the body.

Uptake of pesticides depends, to some extent, on the form (e.g., aerosols, dusts or vapors). However, studies have shown that

occupational exposures most often involve the dermal route. Endrin is an example of an insecticide that is highly toxic when absorbed through the skin. A high level of respiratory protection would usually be appropriate only when an inhalation hazard exists (such as during pesticide spraying operations).

6.5 Solvents

Organic solvents were associated with activities at RMA and several have been detected in groundwater samples. The major classes of solvents that were employed onsite include halogenated aliphatic hydrocarbons (e.g., chloroform, carbon tetrachloride, methylene chloride, trichloroethylene, tetrachloroethylene), aromatic hydrocarbons (benzene, toluene, xylene), and aliphatic alcohols (methanol, ethanol). While many solvents are highly volatile (e.g., ethanol, acetone), others are quite persistent in the environment (chlorinated hydrocarbons). Likewise, organic solvents span the range from practically non-toxic to very toxic.

Two of the more toxic solvents are carbon tetrachloride and chloroform. Both compounds are central nervous system depressants (causing narcotic effects or even coma). Chronic exposure to these compounds may cause liver and kidney damage. In addition, they are suspected carcinogens. As with most organic solvents, vapors result in a common route of exposure. Dermal absorption may also occur upon topical application.

Benzene is a solvent of relatively high volatility resulting in inhalation as the usual route of entry. Acute exposure to benzene results in local skin irritation, or at high concentrations, central nervous system effects (e.g., narcosis). Chronic benzene poisoning causes hematologic (blood) abnormalities and has been linked to leukemia.

Another common industrial solvent, methanol, presents a vapor inhalation hazard (skin absorption can also occur). Acute and chronic exposures result in a variety of systemic toxic manifestations (including visual disturbances). While the overall toxicity of methanol is considered moderate, since it is slowly eliminated from the body, it can be considered a cumulative poison. However, exposure to methanol (and many other solvents) onsite is unlikely due to its volatility.

The presence of solvents would indicate respiratory protection capable of preventing organic vapor inhalation. Another hazard associated with many organic solvents that personnel must be aware of is the flammable nature of this class.

6.6 Other Hazardous Chemicals

This final section serves as a reminder that although many chemicals used at RMA fall into one of the major categories discussed above, a number of toxic chemicals have not been addressed.

For example, corrosive liquids such as sulfuric acid and hydrochloric acid are considered highly toxic. Inhalation of vapors or fumes of concentrated acids causes severe burning to the lungs. Skin contact will result in severe necrosis. Additional examples of hazardous chemicals associated with activities at RMA are hydrazine and dicyclopentadiene. Hydrazine is a very toxic reducing agent. It is a systemic poison that may damage the liver and is an experimental carcinogen. Hydrazine presents a severe explosion and fire danger. Dicyclopentadiene is a compound that was detected in monitoring well samples at the site. This chemical is toxic by inhalation and dermal routes and may also cause a fire hazard.

It is clear that a variety of chemical hazards may be present at the site. Levels of personnel protection will have to be adjusted according to building-specific or location-specific chemical information.

In association with the hydrazine blending facility is nitrosodimethylamine (NDMA). NDMA is an EPA and OSHA regulated carcinogen. Routes of exposure may be through inhalation or absorption through the skin. No acceptable exposure limit is recommended by OSHA.

7.0 TRAINING REQUIREMENTS

The training program for the RMA project is anticipated to consist of the program elements briefly described below. These program elements may be modified to more appropriately suit the needs of proposed field work. Training courses will be offered periodically as necessary.

7.1 General Health and Safety Training

All field personnel will be required to have successfully completed the Ebasco General Health and Safety Training consistent with the Ebasco Corporate Health and Safety Program for Hazardous Waste Sites before initiating any onsite field operations. Other persons involved in the RMA project may attend. This program is designed to incorporate the same elements as that currently included in EPA training courses and will be comprised of approximately 24 hours of classroom instruction and field exercises. For companies providing limited services for brief, intermittent periods of time at the RMA site, special training will be provided in lieu of the general or equivalent training program.

7.2 Advanced Training

An Advanced Training Course will be provided for all personnel expected to perform site work utilizing Level B protection. The course will provide training in the use of protective clothing, self-contained breathing apparatus (SCBA), supplied air systems, air tank change operations and decontamination procedures specific for the level of protection required and the type of operation being conducted. This training will also address confined space entry. The Advanced course will be comprised of approximately 8 hours of classroom instruction and field exercises.

7.3 RMA Site-Specific Training

Training will be provided that will specifically address the activities, procedures, monitoring, and equipment for the RMA project. It will include site and facility layout, hazards and services at the site and will detail all provisions contained within this HASP. This training course will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety for their particular activity. This training will be provided to all companies providing any services downrange at the site.

7.4 RMA Safety Briefing

RMA personnel will be requested to provide briefings for the project personnel where needed to facilitate conformance of Ebasco procedures with those required by RMA. This training will include such elements as RMA emergency and safety procedures, RMA facility capabilities, RMA monitoring instrumentation, hazard recognition, the Chemical Accident Incident Control Plan and other elements as required by RMA protocols.

7.5 First Aid and CPR

The Ebasco Health and Safety Officer and the Project Manager will identify those individuals requiring this training. It is expected that an appropriate number of field workers will receive First Aid training and several selected members of each field team will receive CPR training. These courses will be consistent with the requirements of the American Red Cross Association.

7.6 Daily Safety Briefing

Daily safety briefings, or more frequent operation-specific safety briefings, will be conducted by the Health and Safety Supervisor, and, as appropriate, the H&S Field Officer, prior to the onset of all

field operations. Where procedural deficiencies are identified or where a breakdown in procedural conformity occurs, safety briefings will be conducted to correct the situation. Since these briefings will be procedure or operation-specific, every element to be incorporated cannot be addressed here. However, in general, the following elements will be identified for the purpose of providing a guideline:

- review of Facility Information Sheet
- review of planned activities
- protection levels
- location of safety equipment
- operation-specific hazards
- emergency and evacuation procedures
- decontamination procedures
- communications
- field team responsibilities

8.0 ZONES, PROTECTION, COMMUNICATIONS

8.1 Field Investigation Zones

For field work at RMA, a three zone approach will be utilized where practical. The zones will be identified during safety briefings or otherwise clearly indicated, and will include the Support Zone, the Contamination Reduction Zone (CRZ) and the Exclusion Zone. Site entrance and egress will be through controlled points established for each location under investigation. The Support Zone will contain the mobile Command Post with appropriate facilities such as communications, first aid, monitoring equipment support facilities, and other appropriate facilities. This zone will be manned at all times when field teams are operating downrange. A log book will be kept that will record the progress of all downrange activities as well as for recording employee work records and any other appropriate information. Since the Command Post will be the communications center it will also be the main point for contact with emergency services and will be located near the operation being conducted. When multiple operations are conducted the mobile command post will be located near the more critical of the operations with line-of-sight maintained.

Adjacent to the Support Zone will be the Contamination Reduction Zone (CRZ) which will contain the contamination reduction corridor (CRC) for the decontamination of equipment and personnel. The CRC will contain the fully mobile decon trailer equipped for full personnel decontamination. The trailer will have its own power source, wastewater storage, negative air pressure system, water and air heaters and lighting. The trailer will provide a system for outer clothing wash as well as emergency shower or drench system. It will also contain personnel showers, lockers and redress area. The trailer will be supplied with water from a truck mounted tank, with the water source provided by the RMA Fire Department. When multiple operations are conducted a field decontamination station will be

established near the operation which is not adjacent to the decon trailer and will be used by the field teams before they utilize the full decon facility. As with the Command Post, the decon trailer will be located near the more critical of the operations being conducted.

Other elements in the CRC include facilities for gross boot, glove and outer suit rinse, and a stock of personal protective equipment. The CRC will also provide safety equipment including emergency eyewash, stretcher, fire extinguisher, emergency communications and, where appropriate, rescue equipment such as SCBAs. The CRC is separated from the Support Zone by the contamination control line.

All areas beyond the CRZ will be considered the Exclusion Zone which is separated from the CRZ by the "Hotline." Since there are approximately 100 buildings present onsite for investigation and many drilling operations and other activities, centralized zones and decontamination facilities may be utilized for several buildings or sites where proximity allows, and where there is no possibility for the potential spread of contamination. It should be noted however, that decon procedures will be implemented between entrance to different buildings and field operations.

The Support Zone and Contamination Reduction Zone will contain the Command Post, mobile decon trailers or other mobile elements which can be easily moved to other work locations and will provide protection from weather extremes. Where the area of investigation is a building, the building itself will be defined as the Exclusion Zone. For reconnaissance and sampling, the entrance to the building will be considered as the hotline and all access to the building will be through the entrance path defined for the contamination reduction corridor.

For drilling operations the Exclusion Zone will be established as a minimum 30 foot radius from the drill rig. Observation and sample handling areas will be located upwind in an area established by the

H&S Field Officer. Drilling operations may utilize a modified three zone approach by establishing an intermediate break area for site workers. Where possible the drill rig will be oriented perpendicular to the prevailing wind direction. This area will contain the appropriate safety equipment such as an eyewash, first aid kit, stretchers, etc. The drilling rig will be equipped with a fire extinguisher. These operations may also include initial field decontamination facilities prior to transport to the decon trailer for full personnel decontamination. All facilities that are provided for steam cleaning the drilling rig, augers, sampling devices, etc., will be located so as to preclude impacting other operations and personnel areas. In addition, site operations should not impact steam cleaning operations. The layout of all drilling support facilities is subject to approval of the H&S Supervisor.

For all field operations only authorized personnel will be permitted to enter Exclusion Zones and a log of personnel entering will be maintained at the Command Post.

8.2 Personal Protective Equipment (PPE)

8.2.1 General

The level of protection to be worn by field personnel will be defined and controlled by the onsite Health and Safety Supervisor and will be specifically defined for each operation in the Facility Information Sheet (see Appendix A) and during the daily safety briefing. Basic levels of protection for general operations are provided below and are defined in this section. It should be noted that major levels of protection may be upgraded as appropriate, or downgraded after the H&S Supervisor receives authorization from the Project H&S Officer. Minor modifications may be made by the H&S Supervisor as he deems appropriate.

Task	Level of Protection
H&S Reconnaissance	C
Sampling Reconnaissance	D/C/B
Building Sampling (non-invasive)	C
Building Sampling (invasive)	C/B
Surveying Operations	D/C
Drilling Operations (contaminated areas)	C/B
Drilling Operations (uncontaminated areas)	D
Geophysical Survey	D/C
Sampling Pipes, Vats, Tanks	B/A
Non-entry Manhole Sampling	B
Soil Sampling	D/C
Surface Water Sampling	D
Groundwater Sampling	C
Decontamination (CRC)	D/C
Decontamination Heavy Equipment	C
Decontamination of Sampling Equipment	C/B
Confined Space Entry	B/A
Grouting Operations	D/C
General Clean Area Work	D
Hydrazine Blending Facility Investigation	B

8.2.2 Initial Levels of Protection

Initial levels of protection will be employed during the performance of the Health and Safety Reconnaissance and any other general Reconnaissance. The recon team is anticipated to consist of several members, as required, which may include: the H&S Supervisor, air monitoring specialists, a structural engineer, the sampling team and support technicians. The team will enter unoccupied structures and spill locations generally in Level C protection. However, higher levels of protection may be warranted and will be implemented by the H&S Supervisor where appropriate. Prior to entrance into any building onsite, preliminary Facility Information Sheets (see

Appendix A) will be compiled (i.e., Revision 1) based upon historical information and available data. Subsequent to the reconnaissance the Facility Information Sheet will be updated (i.e., Revision 2) and utilized for future operations. The H&S Reconnaissance will allow for the selection of appropriate protection levels for future operations, decontamination procedures, sampling strategies, and general safety planning. It should be noted that this Health and Safety Plan (HASP) allows for upgrading or downgrading of protection levels to conservatively preclude any potential for contamination while not sacrificing protection or efficiency. During the H&S Reconnaissance, the team will perform various monitoring techniques (see Section 9.0) to indicate the presence of contaminants as well as assessing the integrity of structures in consideration of safety for proposed sampling operations.

8.2.3 Special Levels of Protection

Due to the diverse nature of planned activities at RMA certain operations will require special types of personal protective equipment (PPE). These unique situations will be addressed here.

During drilling operations planned for the lakes at RMA Level D equipment will be utilized. However, all personnel working over water will wear life preservers at all times. In addition, personnel responsible for sample handling will wear a splash shield, protective clothing (TYVEK or Chemical Apron, etc.) and chemical resistent gloves during sample transfer and packaging efforts. The use of a full-face respirator may be employed based on the judgement of the H&S Supervisor.

For Phase 1B sampling of certain buildings for the project, levels of protection will be identified by the H&S Supervisor, in consultation with the H&S Officer. The establishment of these levels will be based on the results of Phase 1A, H&S Reconnaissance, the type of sample to be obtained, the logistics of access to the location and the environment into which the team must enter.

The protection level for manhole sampling will be a modified Level B. These criteria only apply to sampling where personnel do not enter the manhole. The team will consist of an H&S Officer and a sampling technician with a support person, if necessary. The team will use SCBAs, TYVEK suits, chemical resistant gloves and boots and will don this equipment just prior to the manhole opening and remove this equipment only after the sample has been packaged and the manhole closed. Since remote sampling will be utilized modifications to taping and decon procedures will be appropriate.

The level of protection for drilling operations will generally be Level C, or B however in certain locations where all available information indicates no contamination and on the decision of the H&S Supervisor, in consultation with the Project H&S Officer, Level D drilling may be conducted provided a H&S Field Officer performs monitoring. For Level C operations several modifications may be employed to lessen heat stress provided monitoring indicates this is consistent with good safety practices. Such modifications may include but not be limited to the use of hoods, taping procedures, the type of air purifying respirator used and the types of cartridges employed.

After drilling has been completed, grouting of the boreholes will be accomplished in the level of protection established by the H&S Supervisor and the operations may proceed without additional monitoring by the H&S Officers unless special or unusual conditions exist and at the discretion of the H&S Supervisor. Mixing of grouting materials should be accompanied by the use of cartridge respirators or other appropriate protection.

Field operations conducted in areas potentially containing chemical agents will be conducted in Level C or B (as established by the H&S Supervisor) with certain modifications. Persons who will possibly have contact with soil materials, e.g., the driller's helper, geologist, will wear additional PPE such as chemical apron and butyl rubber gloves as appropriate. Canister type respirators may also be

appropriate. In addition, upon indication of the presence of chemical agent, confirmation of presence will be conducted by the H&S Supervisor in appropriate upgraded respiratory protection, (see Appendix F for further details).

For the investigation of the Hydrazine Blending facility Level B protection will be utilized by the entire field team including the air line tender. Protective clothing will be utilized to prevent any skin contact with site location materials including both soil and water. This will also be utilized when sampling existing wells not within the facility boundary unless monitoring indicates that personnel protection less than Level B is appropriate. The H&S Supervisor will implement the level of protection to be used by the field team. The PPE for well development and sampling will be assessed from previous data developed under another contract, through monitoring by the H&S Field Officer, and on the judgement of the H&S Supervisor.

8.2.4 Personnel Protective Equipment for Specific Levels:

For Tasks requiring Level A Protection:

- Open circuit, positive pressure-demand SCBA;
- Totally encapsulated chemical-resistant suit;
- Gloves, outer (chemical protective);
- Boots, chemical protective, steel toe;
- Booties (chemical protective) optional;
- Hard hat;
- Voice amplifier; and
- 2-way radio (intrinsically safe)

For Tasks requiring Level B Protection:

- Open circuit, positive pressure-demand SCBA;
- Chemical protective suit (e.g., Saran TYVEK)
- Chemical protective hood;

- o Gloves, inner (surgical type);
- o Gloves, outer (chemical protective);
- o Boots (chemical protective), steel toe;
- o Booties (chemical protective);
- o Hard hat;
- o Voice amplifier (optional); and
- o 2-way radio (intrinsically safe).

For Tasks requiring Level C Protection:

- o Full face air-purifying respirator;
- o Emergency escape respirator (carried when appropriate);
- o Chemical protective suit (e.g., saran or polycoated TYVEK)
- o Gloves, inner (surgical type);
- o Gloves, outer (chemical protective);
- o Boots (chemical protective), steel toe;
- o Booties, (chemical protective);
- o Hard hat (optional eye protection); and
- o 2-way radio (intrinsically safe).

For Tasks requiring Level D Protection:

- o Air purifying or emergency escape respirator (carried);
- o Coveralls;
- o Gloves (chemical resistant);
- o Boots/shoes (safety);
- o Booties (optional); and
- o Hard hat with optional eye protection.

8.2.5 Safety Equipment

Basic emergency and first aid equipment will be available at the Support Zone and the CRC, as appropriate. It will include communications (telephone, walkie-talkies, air horns), eye wash, emergency shower or drench system, fire extinguishers, first aid kits, stretchers and other safety related equipment. A backup team

will be stationed in the Support Zone or CRZ, when identified as necessary by the Health and Safety Supervisor, to be available to provide support for emergency situations involving downrange teams. This will be especially important when Level A or B operations are conducted. In addition, the Command Post will be manned during all times when teams are downrange, communications will be maintained, and personnel will be available to assist in deconning procedures for personnal and equipment. Decontamination equipment will be located in the contamination reduction corridor. Drill rigs located in the Exclusion Zone will also be equipped with a stretcher, first aid kit, air horn and fire extinguisher.

8.3 Communications

- Walkie-Talkies - Hand held units will be utilized by field teams for communication between downrange operations and the Command Post base-station.

- Telephones - A mobile telephone will be located in the Command Post trailer in the Support Zone for communication with RMA site emergency services/facilities. Another telephone will be located in the Support Trailer for conducting nonemergency project business.

- Air horns - These will be carried by downrange field teams and also will be maintained at the Support Zone for initiation of emergency evacuation procedures or rescue (see Section 14.0).

- Sirens - Controlled by the Army as specified in the RMA Chemical Accident and Incident Control Plan (see Section 14.0 for details and Figure 10).

- Hand signals - To be employed by downrange field teams while utilizing the buddy system.

- Voice Amplification System - Battery operated voice amplifiers will be used by teams in Level A protection and optionally in Level B protection, and as necessary when downrange operations are conducted.

9.0 MONITORING PROCEDURES

9.1 Health And Safety Reconnaissance

9.1.1 Initial Entry Methodology

Due to the wide variety of chemicals which may be present in onsite buildings and structures as well as drill or other operation locations, an initial survey (the Health and Safety Reconnaissance) must be performed in order to assure proper personnel protection levels during future sampling operations. For investigation of onsite buidlings and structures, this Reconnaissance is anticipated to require a multidisciplinary team, as required which may include; a structural engineer, the sampling team, a Health and Safety (H&S) Officer, technician/support personnel, chemical operations engineers and an Air Monitoring Specialist. The H&S Building Reconnaissance will be accomplished by using real time monitors and sample collection devices and media. The types of real time monitors to be used will be determined by H&S Supervisor. Sample collection will be comprised of "Building Area Samples" and "Personnel Samples." Building Area Samples will be collected for each individual building and will always be analyzed. Personnel samples will be worn by one selected individual, identified by the H&S Supervisor or Field Officer, during the Reconnaissance for the entire day of operations. These will only be analyzed if the analysis of the Building Area samples for that day indicates significant contamination of concern, direct reading instruments measure high levels of unknown contaminants, or on the judgement of the Project H&S Supervisor. Table 9.1-1 indicates specific criteria pertinent to this decision. Both of the above samples will be gathered using portable sampling pumps and appropriate collection media. Initially these solid sorbent samples will be collected during the H&S Reconnaissance, but may also be utilized during other operations where data indicates a need or based upon the

TABLE 9.1.-1

CRITERIA FOR PERSONNEL SAMPLE ANALYSIS

Instrument	Criteria
HNU PI-101-PI	IP either 10.2 eV or 11.7 eV probe continually responds in Dexcess of 5 ppm above background levels in the breathing zone, the Personnel Sample will be analyzed. For field operations, if PID readings initiate evacuation procedures, personnel samples will be analyzed.
OVA Model 128-FID	If the survey mode continually responds in excess of 10 ppm above background levels in the breathing zone, field analysis in GC Mode is required. If the field analysis of the building is significantly different (i.e., more or large peaks in chromatograms) from field analysis of background levels, Personnel Samples will be analyzed. For field operations, if FID readings initiate evacuation procedures, personnel samples will be analyzed.
Portable Sampling Pumps with Sorbent Tubes	If the analysis of an individual Building Area Sample indicates significant concentrations of compounds of concern, the personnel sample collected that day will be submitted for analysis.
M-8 Alarm	If a positive reading is indicated with this instrument, and the reading verified, personnel samples will be analyzed.

judgement of the Project H&S Officer. The samples will be collected as composite and/or hot spot samples. The collection media will consist of Tenax and carbon sorbent traps or a train of sorbent traps as recommended by the air monitoring specialist and instituted by the H&S Supervisor.

These samples will be used to assess the contamination levels in buildings as well as for documenting worker exposure. Desorption and GC/MS analysis of the solid sorbent samples will also provide data beyond the range of direct reading instruments.

Real time monitors (direct reading instruments) will be employed during building entrance to ensure that personnel protection levels are adequate, to locate potential sources of contamination, and to aid in the location of the Building Area Samples.

Table 9.1-2 lists the parameters and methods of monitoring for the Health and Safety Reconnaissance. This table lists the monitoring procedures for a "worst case building." If available information indicates sufficient reason to suspect that a particular parameter is not of concern, then the monitoring procedure will be modified to reflect this. For example, when surveying an office building which background information indicates was never used for Army agent or pesticide production, storage, or disposal, the monitoring procedures will be curtailed or modified to reflect this situation.

For buildings which require Army agent monitoring during the H&S Reconnaissance, the Army M-8 Alarm will be used to continuously monitor for selected chemical agents. In addition the M18A2 Chemical Agent Kit will be used to monitor Army agents in air and standing water when appropriate. The kit's indicator paper will also be used to test any standing liquids found in the buildings and detector tubes utilized to monitor the air.

TABLE 9.1-2

HEALTH AND SAFETY RECONNAISSANCE
MONITORING REQUIREMENTS

Parameter	Instrument/Method	Comment
Army Agent	M18A2	Sample air, and water using tubes and test paper for agents (blood, nerve, choking, blistering) where applicable
	M8-Phosgene-Meter	Use as continuous monitors where applicable
Oxygen Deficient-Explosive Atmosphere	Combustible Gas/Oxygen Meter	O_2-LT 19.5% level B mandatory; O_2 LT 16% level B mandatory, recalibrate O_2 dependent instruments
Organic Vapors	FID	Continuous Monitor - 10 ppm above background triggers OVA-GC Mode; Significant difference between building and background GC triggers locating building area sample.
	PID	Continuous monitor - 5 ppm above background triggers Solid Sorbent Analysis
	Solid Sorbent Personnel Sample	Continuous of each building for laboratory analysis dependent on real time monitor and Building Area Sample results
	Solid Sorbent Building Area Sample	One continuous sample per day for laboratory analysis
Inorganic Group	Hg Meter	Sample Continuous Monitoring using Jerome Mercury monitor for TLV where applicable
	Cl_2 Meter	Using MSA Chlorine Monitor for TLV where applicable
	CO Meter	Using MSA Carbon Monoxide Monitor for TLV where applicable
	H_2S Meter	Using MSA Hydrogen Sulphide Monitor for TLV where applicable
Asbestos	Dust Samples	From composite dust sample. Triggers Monitoring Program if present.
Pesticides & Raw Matl. Metals		From composite dust sample - laboratory analyses by EPA Method 625
		From composite dust sample - laboratory analyses by Appendix IV ICP for Trace Element Analyses
Hydrazines	Auto Step Monitor	Continuous monitor. 0.1 ppm triggers sorbent analysis
	Solid Sorbent Personnel Sample	Continuous for each days activity for laboratory analysis dependent on real time monitors

All buildings will be surveyed for organic vapor content during the H&S Reconnaissance. This monitoring will be accomplished in two phases. First, real time monitors (FID and PID) will be used in accordance with Ebasco standard operating procedures. The HNU-Photo Ionization Analyzer - Model PI-101 (i.e., the PID), will be used with the 10.2 eV and/or 11.7 eV probes. The 10.2 eV probe is the most sensitive, however, it is not capable of detecting several compounds which may be present (e.g., Phosgene IP = 11.77 eV). While the 11.7 eV probe is not as sensitive as the 10.2 eV probe, it is capable of detecting a wider variety of compounds. The Foxboro Organic Vapor Analyzer Model 128 (OVA), (i.e., the FID), will be used in the survey mode. Any readings in excess of 10 ppm above background will be field analyzed using the OVA's GC mode. For example, HNU readings above 5 ppm and OVA readings above 10 ppm, with significant differences between background chromatograms and building chromatograms, will automatically have their Building Area Samples located in the proximity of these readings.

Second, where appropriate, buildings will be surveyed for explosive or oxygen deficient atmosphere during the H&S Reconnaissance. A Combustible Gas Indicator and Oxygen Meter will be used in accordance with Ebasco standard operating procedures. The primary concern will be to determine if the building atmosphere contains enough oxygen to support life. A secondary concern will be to determine if the remaining survey instruments, which are dependent on the amount of oxygen present, will need to be recalibrated to correct for any deviation which would result from an oxygen deficiency. Monitoring for explosive atmospheres is mainly aimed at providing worker protection, but will also be used to provide an initial indication of the contamination levels so that FID and PID monitoring can be optimized.

For buildings which require inorganic gas monitoring during the H&S Reconnaissance, a gold film mercury monitor, a chlorine monitor, a carbon monoxide monitor, and a hydrogen sulfide monitor will be used

in accordance appropriate operating procedures. The primary concern will be to determine if the levels of either gases are in excess of TLV.

All buildings will be sampled for dust content during the H&S Reconnaissance. A dust collection device consisting of a brush and stainless steel collector, will be used to gather a composite sample throughout the building. In addition, samples of any friable material will be collected. The primary concern for dust samples is whether or not asbestos, raw materials, pesticides and metals, are present. Respirable dust will be monitored with a TST Model 3500 (direct reading instrument). A portion of the composite sample and all samples of friable material will be analyzed for asbestos. If asbestos is found to be present, monitoring procedures which meet EPA and NIOSH criteria may be initiated during future building operations as required by law.

Dust samples for each building will be sent to the laboratory for analysis. The dust samples will be Soxhlet extracted with methylene chloride for 24 hours. EPA Method 625 (FR Vol 44; Dec 3, 1979) will then be used to analyze for Base/Neutrals, Acids and Pesticides. In addition, Appendix IV will be used to determine if metals are present by ICP for Trace Element analysis.

If any of the dust target compounds are detected, special attention will be given to ensuring that personnel protection levels, monitoring procedures, and decontamination procedures are sufficient to protect workers involved in sample collection.

9.1.2 Initial Reconnaissance - Other Site Investigations

Site Investigations for such operations as drilling, soil sampling, and open facility investigation require an initial reconnaissance prior to commencement at any operations. All available information concerning the operations and chemicals used at the site will be reviewed before the reconnaissance. The initial protection level

will be set at C. This level is subject to revision by the H&S Supervisor based on results from direct reading monitoring instruments, existing information or as site conditions necessitate.

Monitoring instruemnts to be used on a reconnaissance operation include a combustible gas monitor, FID, PID, and M-8 alarm. Evacuation and/or upgrading to Level B protection will be dependent on the action levels registered by the instruments. The action levels of the instruments are as follows: combustible gas monitor with an oxygen level less than 19.5% or LEL greater than 25%, FID greater than 10 ppm background, PID greater than 5 ppm background, and when the levels exceed the TLV for inorganic gases. If any of these conditions exist the protection levels must be increased to Level B until it is determined that the compound or compounds causing this reading is appropriate for Level C protection or does not pose a health and safety hazard.

Personnel monitoring will be conducted under adverse conditions, high readings on direct reading monitoring instrumens, or at the discretion of the H&S Supervisor. One H&S sample will be collected everyday and analyzed according to the criteria provided in Table 4. A H&S sample will be sent into a lab once a week unless the H&S Supervisor determines that samples should be sent in more frequently based on the above criteria. The individual who will be selected to wear the personnel monitoring equipment will be based on the liklihood that the individual will receive the greatest potential exposure. Analysis of the samples will include EPA volatile organic priority pollutants and the next 20 most abundant compounds.

Since very little information can be obtained on dust constituents during the H&S Reconnaissance, extreme care must be taken to avoid or minimize contamination by or exposure to potentially contaminated dust. When the H&S Supervisor judges that dust may be a problem, monitoring with a TSI Model 3500 respirable dust meter will be conducted.

9.1.3 Drilling Operations

Normal drilling operations will be conducted with Level C protection in potentially contaminated areas but at the discretion of the H&S Supervisor may be upgraded to Level B. Therefore, it is imperative that continuous monitoring be conducted to ensure that the level of protection is adequate. Upgrading to Level B will be necessary in areas where insufficient information on the chemical hazards exists, contaminants potentially present cannot be measured by available instrumentation, contaminants have poor warning properties or extreme toxicity, or other factors identified by the H&S Supervisor. Upgrading may also occur when monitoring results indicate that Level C provides insufficient protection (see Table 9.1-3). Areas where sufficient valid historical information is available indicating no possible contamination may, at the judgement of the H&S Supervisor, initiate Level D drilling operations with continuous monitoring by the H&S Specialist. Monitoring during well drilling operations must assess the contamination levels in the borehole, samples and in the breathing zone. Monitoring for chemical agents, explosive conditions, and organic vapors will be conducted as described herein and in Appendix F.

Monitoring for the presence of combustible gases will be conducted in the borehole, and in the breathing zone (work area). Measurements of greater than 25% LEL in the work area near the borehole will necessitate evacuation of all personnel to a safe area upwind of the drilling operation, identified by the H&S Supervisor or Field H&S Officer. The operational area will not be re-entered until the H&S Supervisor has evaluated the situation and indicated that work may resume. Readings greater than 10% LEL in the work area require that continuous monitoring and extreme caution be exercised while drilling operations continue. Borehole readings greater than 50% LEL require that operation be stopped, personnel evacuated, and venting or gas displacement (e.g., CO_2, N_2) procedures employed. If levels do not decrease, responsible parties will be notified (i.e., the Fire

TABLE 9.1-3

CRITERIA FOR TEAM ACTION OR SELECTION OF PPE

1) Army Agents

Air - Positive identification of presence by Alarm from M-8 meter and positive indication (color change) with colorimetric detector tubes from M18A2 Chemical Test Kit. Evacuate, notify appropriate RMA authorities.

Soil - Same as above

Water - Positive indication using M18A2 Test Paper. Evacuate, notify appropriate RMA authorities

2) Oxygen Deficient Environment

LT 19.5% Level B Mandatory
LT 16.0% Level B Mandatory, Recalibrate Instruments

3) Combustible/Explosive Environments

GT 25% LEL - Evacuate Personnel
10-25% - Monitor LEL and O_2 continuously
LT 10% LEL - Level C Acceptable - monitor as normal
GT 50% LEL -In borehole, suspend operations, vent, monitor continuously

TABLE 9.1-3 (Cont'd)

4) Organic Vapors in Respiratory Zone

GT 10ppm with FID - Level B Mandatory, Continuous Monitoring, send Personnel Sample for Analysis

LT 10 ppm with FID - Monitor as Normal, Level C

GT 5 ppm with PID - Level B Mandatory, Continuous Monitoring, send Personnel Sample for Analysis

LT 5 ppm with PID - Monitor as Normal, Level C

GT TLV for Solid Sorbent Tube Analysis (specific compounds identified Level C mandatory with Monitoring check Applicability of Respiratory Protection).

LT TLV for Solid Sorbent Tube Analysis, (specific compounds identified) Level D or C may be acceptable, continuous monitoring required

5) Presence of Inorganic Gases

LT TLV for Hg with Hg Meter - Monitor as normal.

GT TLV for Hg with Hg Meter - Level B/A mandatory

LT TLV for Cl with CL Meter - monitor as normal Check applicability of PPE

GT TLV for Cl with CL Meter - Level B/A mandatory

LT TLV for CO with CO Monitor-monitor as normal check applicability of PPE

LT TLV for H_2S with H_2S Monitor - Monitor as normal

GT TLV for H_2S with H_2S Monitor - Level B/A mandatory

6) DUST

Asbestos Present - Level C - OSHA monitoring required

Pesticides Present - Level C - Monitor for Respirable Dust

Metals Present - Level C - Monitor for Respirable Dust

Respirable Dust Level - with dust meter - must be below TLV of worst case component x its percent presence times Level C Mask Protection Factor of 50. If not below respirable Dust Level, Level B mandatory

Department and the Chemical Accident Incident Control Office - CAICO). This situation may require that the borehole be backfilled and abandoned. Readings between 25-50% LEL in the borehole require that H&S personnel perform continuous monitoring and that caution be exercised until concentrations are less than 25% LEL.

Organic vapors will be monitored at the borehole, drill cuttings, core sample and in the respiratory zone. PID readings greater than 5 ppm and FID readings greater than 10 ppm in the respiratory zone require that personnel protection be upgraded to Level B. Monitoring of the borehole, core sample and drill cuttings will be conducted to assist H&S personnel in identifying a potential respiratory problem before it develops. Data collected by H&S personnel may be used by other members of the field team where appropriate. Other monitoring will be utilized to assist the H&S Supervisor or Field Officer in identifying a potential situation where organic levels may present a respiratory problem.

The following procedures will be utilized not only when site operations take place in areas where there is the potential presence of chemical agents, but also when routine monitoring in other onsite locations gives positive indications on agent monitoring instruments. The Army M-8 alarm will be utilized to screen the borehole, cuttings and the core sample as well as the respiratory zone. A positive indication with this instrument will be followed by a second reading with another M-8, if available. After measurements with the M-8 are completed, the M18A2 colorimetric detector tubes (blue band), will be utilized to verify the M-8 readings. Portable sampling pumps will be used to draw an air sample through the tubes at 2 liters per minute. If the colorimetric tubes also give a positive reading, operations will cease and the Technical Escort Unit (TEU) and other appropriate parties will be notified.

Monitoring procedures will include splitting open of the four foot core sample and careful examination with the blue-band colorimetric detection tube from the M18A2 Kit. The core should also be allowed

to reach a temperature of approximately 70°F or higher to allow mustard potentially present, to volatize. A device is presently under development that will provide for core heating when ambient temperatures preclude the core from reaching the required temperature. If positive indication is obtained, the test should be repeated. If the same result is observed, appropriate stop-work and notification procedures will be implemented. Appendix F, "Chemical Agent Response Guidelines," will provide additional information regarding how to handle chemical agent situations.

For all drilling operations in areas potentially containing chemical agents, a small amount of soil will be removed from both the top and bottom of the one foot section of the core sample. This material will be placed in a container of solvent and delivered to the RMA Laboratory for analysis. Other samples may be sent to the RMA laboratory for analysis based on monitoring results and at the discretion of the H&S Supervisor. A positive indication of the presence of agent in the sample will require that the one foot core not be sent to the contractor laboratory. This sampling procedure will also be employed when monitoring, as described above, also gives positive indication of agent presence in areas not previously identified as chemical agent areas.

As part of drilling operations in contaminated areas, potentially contaminated solid wastes will remain after the operation has been complete. If the wastes are not known to be contaminated they must then be treated as contaminated until otherwise known. As temporary storage, the solid waste will be covered to prevent dispersion of the soil. If it is later determined that the wastes were contaminated then the waste will have to be containerized in 55 gallon drums for proper hazardous waste disposal. If the waste is determined not be be contaminated then it may remain in the state it is in.

9.1.4 Building Operations

Sample collection will normally be executed with Level C protection unless the results of the H&S Reconnaissance indicate higher protection levels are required. Table 9.1-3 provides criteria for selection of personnel protection during sample collection. Particular attention must be given to monitoring procedures to ensure that this level of protection is adequate and that conditions have not significantly changed since the H&S Reconnaissance. The following discussion details concerns which must be addressed.

Continuous monitoring with the M-8 Alarm and composite area testing with the M18A2 test kit will be used to test the air during building sampling. If any level of chemical agent is detected the building must be evacuated, verification made in appropriate upgraded PPE, and notification to the proper authorities initiated (see Section 13.0). H&S personnel in conjunction with Army representatives will then determine what further course of action should be taken.

Continuous monitoring with a Combustible Gas Indicator, if appropriate, will be used to test for the presence of a combustible environment. This meter is equipped with an oxygen meter and also with a CO sensor or H_2S sensor as appropriate for the location under investigation. If oxygen levels fall below 19.5%, the building must be evacuated and protection levels upgraded to Level B. In addition if oxygen levels fall below 16%, the oxygen dependent field instruments (e.g., FID, Combustible Gas Indicator) must be recalibrated for the O_2 levels which will be encountered. If the Combustible Gas Indicator indicates levels greater than 25% LEL, the buildings must be evacuated. The Health and Safety Supervisor will determine when the building may be re-entered so as to continue operations. If the Combustible Gas Indicator indicates levels less than 25% LEL, operations may continue provided continuous monitoring is employed.

Continuous monitoring with an FID and PID will be used to test the ambient air levels. If the PID exceeds 5 ppm, or the FID exceeds 10 ppm, the building must be evacuated. Protection levels must be increased to Level B until it is determined that the compound or compounds causing this reading can be handled by Level C protection or does not pose a health and safety hazard.

Monitoring with the PID and FID will also be used to identify potential locations of vapor emissions or problem areas, e.g., spills, for future sampling events.

Solid sorbent tubes containing Tenax and charcoal in parallel will be worn by one individual in the building sampling team. This sample will be collected throughout the day and will be designated as the Personnel Sample. At least one H&S sample will be collected every day and analyzed if any action levels were triggered. Analysis will include EPA Volatile Organic Priority Pollutants, and the next 20 most abundant compounds. The objective of this sample is to evaluate whether workers were exposed to low level compounds which the field instruments cannot detect.

Monitoring with a mercury, carbon monoxide, hydrogen sulfide and chlorine monitor will be used to test the air. If any monitor indicates levels above the TLV, for the compound of concern, the type of respiratory protection must be evaluated. Protection levels may be increased to Level B, or other appropriate respiratory protection employed, before the Building Sample collection can continue.

If chemical agents are determined to be present or suspected, the H&S Supervisor will be advised and contact with the Fire Department, Technical Escort, and the Chemical Accident Incident Control Office will be established as appropriate. If asbestos is present, Level C protection is adequate. However, federal law requires specific monitoring procedures which will be initiated for subsequent building activities, if any. If base/neutrals, acid extractables, pesticides or metals are present in sufficient quantities, the Project H&S

Officer or Supervisor may require monitoring for nuisance dust. If nuisance dust levels exceed the standard, Level B protection may be required during building sample collection, however, this situation is unlikely to occur during sampling operations.

Dust monitoring will be conducted using a direct reading dust monitoring instrument (TSI Model 3500) which were to be used to establish the level of respirable dust present. This level must not exceed the value established by the following procedure. The "worst case" contaminant will be identified and its TLV indicated. The highest concentration present or assumed, as a percent, will be established and an air purifying respirator protection factor of 50 will be used. A calculation with these three factors will be compared to the respirable dust level present and if the result is less than the dust level, Level C respiratory protection will be adequate. If more, upgrading of respiratory protection is warranted.

9.1.5 Manhole Sampling Operations

Sampling at manholes or similar structures should be conducted by remote sampling instrumentation whenever possible. Level B PPE will be worn for these operations. The team will consist of the H&S Supervisor or Field Officer, a sampler and, as appropriate, one support person. Monitoring will be performed subsequent to the donning of PPE by the H&S Supervisor or Field Officer. Instrumentation will include a PID, FID, Combustible Gas Indicator and the M-8 Alarm. Other monitoring equipment will be used as specified by the H&S Supervisor. After the manhole is closed and appropriate decontamination measures taken, Level B equipment may be removed. Before sampling another manhole, protective gloves will be changed and any other PPE which has been contaminated will be replaced.

9.1.6 Confined Space/Limited Egress Operations

Entry into a confined space/limited egress (CS/LE) area, such as manhole, vats, tanks, etc., require special precautionary procedures. Procedures for entry, monitoring, personal protective equipment, and work practices are outlined in Appendix G. Personnel required for a CS/LE operation include the H&S Supervisor, entry team, and standby personnel. The individuals entering the space will be required to wear Level B respirator protection. In certain cases Level A may be required, such as the case where the FID exceeds 500 ppm of an unknown compound. Depending on the suspected contaminant varying degrees of protective clothing will be worn. The decision will be based upon the opinion of the H&S Supervisor. Additional safety equipment such as life lines, safety belts, body harness, or wrist type harness will be employed when entering a CS/LE area.

Before entering a CS/LE area initial testing shall be conducted to determine if the atmosphere in the CS/LE is safe. Monitoring shall be conducted for oxygen content, combustible gases/vapors, toxic contaminants (FID and PID instruments), and any other tests specified by the H&S Supervisor. Continuous monitoring of the CS/LE shall take place while personnel are in the CS/LE enclosure. Once samples have been completed the enclosure shall be resealed and decontamination procedures will then take place. If additional sampling is to be performed than PPE which has been contaminated will be replaced before entering another area.

9.1.7 Hydrazine Blending Facility Investigation

Monitoring shall take place while working in areas which are known or suspected of having hydrazine. Prior to and during sampling operations the H&S Supervisor shall use a direct reading instrument to monitor total hydrazine levels. Monitoring of existing equipment will be performed to identify any potential existing sources of hydrazine.

Personnel monitoring for hydrazine will be conducted using firebrick sorbent traps analyzed for hydrazine fractions, i.e., dimethylhydrazine, monomethylhydrazine, and anhydrous hydrazine. Samples will be sent to the lab whenever an overt exposure occurs, direct reading instruments indicates a value above the TLV for anhydrous hydrazine, or as the H&S Supervisor judges appropriate. Personnel monitoring will also be performed for nitrosodimethylamine (NDMA) using a sorbent trap containing ThermoSorb N. These samples will be sent in for analysis two times a week on days, as judged by the H&S Supervisor, representing maximum effort field operations or when personnel exposure has occurred or was suspected. Each day, while operations continue in the hydrazine blending facility, an individual with the possiblity for high exposure shall wear a monitoring device. If no readings are observed on the direct reading instrument then the H&S Supervisor will determine if one or more samples per week will be sent to the lab for analysis.

9.2 Personnel Monitoring Procedures

During the H&S Reconnaissance of Buildings one member of the team will wear a portable sampling pump with a collection medium (i.e., charcoal and Tenax) or other appropriate media on a daily basis as described above. In addition, personnel monitoring will be performed during other sampling or investigation operations, at the discretion of the H&S Supervisor or Project H&S Officer in consideration of the type of operation being conducted, results of monitoring, and the nature of the location relative to the degree of contamination potentially present. This monitoring will be performed periodically during sampling to document worker exposure to organic vapors or other contaminants, e.g., asbestos or nuisance dusts, and entered into the worker exposure record. In instances when field workers are to work in an area, for more than one day, where OSHA regulated substances (29 CFR1910) are present then personnel monitoring will be conducted.

Other personnel sampling will be employed for each operation as previously described under the respective section (e.g., hydrazine monitoring). In all cases the personnel monitoring will be conducted for the worst case situation in order to provide for a conservative estimate of all field team potential exposure. In general personnel samples will be sent for lab analysis when direct reading instruments indicate, under adverse conditions or at the discretion of the H&S Supervisor.

9.3 Medical Surveillance Procedures for Evidence of Personal Exposure

All Ebasco employees and subcontractors who will be performing field work at RMA will be required to have passed Ebasco's medical surveillance examination. A release for work for all site workers will be confirmed by the Project H&S Officer before an employee can begin onsite activities. The exam will be taken annually at a minimum and upon termination of employment. The Medical Data Sheet provided in Section 16.0 will be completed by each field team member prior to conducting site activities. This form does not substitute for participation in the Medical Surveillance Program and will be kept at the Command Post at all times. It will accompany any field team member who must be transported to the hospital. For work at RMA an additional test will be performed (i.e., cholinesterase testing) periodically. For full-time workers this will be done every 40 site days or two months (whichever comes first). For those individuals who perform intermittent work the test should be repeated after 40 site days or 4 months (whichever comes first). If an individual has performed work at RMA for a period of time less than 40 site days and who will not be returning to the site, the cholinesterase test will be taken when their work is completed. If the results of any cholinesterase test fall below normal range or change within the normal range by more than 20%, retesting will be warranted. Any retesting performed to verify a problem cholinesterase reading will be accompanied by liver function testing and abstinence from alcohol for four days. In general, whenever any medical result yields an

abnormal reading, the test will be repeated. The Project H&S Officer will be advised of this situation and may require additional tests or changes to testing frequency. Whenever medical monitoring is verified and indicates a potential problem, the site worker may no longer go downrange until a medical release is given. Special testing may also be required (e.g., serum metals) based upon site situations and discussions between the Project H&S Officer and consulting physicians available through Ebasco's Medical Surveillance Program provided by Executive Health Examiners. Ebasco's program also contains special provision for monitoring for cardiac related matters by development of a Risk Profile Analysis, heavy metals screening and suitability for respirator use. The results of the medical monitoring program will be transmitted to the individual.

10.0 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

10.1 General

All field sampling will be performed under the level of protection described in Section VIII, specifically indicated in the Facility Information Sheet (see Appendix A), and instituted by the Health and Safety Supervisor. The level of protection will be established by review of facility history, available data, and especially by the results of the Health and Safety Reconnaissance and other monitoring (see Section 9.0 and below) performed for each building, facility or spill location.

10.2 Health and Safety Reconnaissance

Safety considerations during the H&S Reconnaissance are important since the H&S Reconnaissance will precede all other field operations. The H&S Reconnaissance will generally be conducted under Level C at a minimum; however, Level D may be used in presently occupied buildings and those certified as clean provided there is sufficient support information to justify Level D protection. Higher levels of protection, i.e., Level B, may be employed at the discretion of the Project H&S Supervisor and Officer when certain adverse conditions exist. These may include such situations as the presence of inorganic vapors not seen by direct reading instruments or when substances with extremely low TLVs may be present.

The reconnaissance team, may consist of the H&S Supervisor or specialist, a structural engineer, the sampling team and technical support personnel. They will maintain line of sight with each other at all times and maintain communication with the Command Post located in the Support Zone. Monitoring will be performed as indicated in Section 9.0 and will be used to alert the recon team if a dangerous

situation exists and also to assist in prescribing levels of protection for future site operations. No contained vessels, pipes, vats, etc., should be opened or confined spaces entered. If the presence of any chemical agent is indicated or if the presence of UXO is suspected, the team will immediately leave the facility, and the Site Manager or H&S Supervisor will initiate notification to the Fire Department and the Chemical Accident Incident Control Office (CAICO). When structures, e.g., buildings, are entered the structural engineer must be aware of the building integrity for the rest of the team. Any physical hazards observed should be recorded on the Facility Information Sheet with the results of monitoring data incorporated as revisions of the Facility Information Sheet. All safety equipment and emergency systems should be checked before entry. Appropriate authorities such as the Fire Department should be notified of the planned activities for the day.

10.3 Field Sampling Operations

10.3.1 Invasive Operations

A Health and Safety Field Officer will be present during all invasive work, e.g., drilling operations, and will provide H&S monitoring to ensure that appropriate levels of protection and safety procedures are utilized. The location of water, sewer and electrical lines will be confirmed before any invasive operation is attempted. All drilling and associated operations will be performed with spark proof tools and intrinsically safe equipment when working on structures which possibly contain flammable or combustible materials. The possibility for the presence of underground conduits or vessels containing materials under pressure will be investigated before attempting any sampling operations. An Ebasco subcontractor will employ geophysical techniques on proposed invasive sampling locations where needed to detect the presence of any UXO (in UXO identified areas) or other buried objects. Such techniques reportedly can clear a proposed location to a depth of five feet.

At this time no drilling or invasive work is planned in areas where undetonated explosives exist.

This situation has been established by project management and verified through verbal discussions and document research. If at such time areas classified as potentially having unexploded ordnance are proposed for invasive site operations, this HASP must be amended to provide guidelines that will ensure the safe conduct of work. Such an amendment will include safety protocols, personnel responsibilities, location map and sign off by project management.

Properly sized containment systems will be utilized and consideration to the potential amount and type of liquid or other waste materials released during operations will be discussed with health and safety personnel and sampling team members to minimize the potential for spills and provide for collection of waste materials. The location of safety equipment and evacuation procedures will be established prior to initiation of operations. The use of salamanders is prohibited and the use of all protective clothing especially hard hats and hoods will be required during drilling or other heavy equipment operations. All contaminated equipment, e.g., augers, split spoons, drill pipe, etc., will be placed on liner material when not in use or when awaiting steam cleaning. Communications will be maintained at all times. Personnel responsible for grouting boreholes will wear the PPE defined by the H&S Supervisor consistent with monitoring results of the drilling operation.

When drilling in areas potentially containing chemical agents, or when monitoring provides positive indication (see Section 9.0 and Appendix F), special precautions should be observed. Persons who will possibly have direct contact with soil materials should wear additional PPE. This will include the use of butyl rubber gloves and a butyl rubber chemical apron, or equivalent. When positive indications by monitoring devices is observed, all necessary subsequent actions will be executed in upgraded PPE, as appropriate.

considerations Personnel will carefully decontaminate as indicated by the onsite H&S Supervisor. Decontamination of any potentially contaminated equipment will be directed by Technical Escort. Contact with any equipment, material or objects, possibly contaminated with agents, will be strictly avoided.

10.3.2 Soil, Surface Water, Liquid Waste Sampling

Sampling of soils, standing liquids, and other sampling in open areas is addressed here. Personnel must wear prescribed clothing (PPE) including eye protection, chemical resistant gloves and splash aprons (where appropriate) when sampling liquids. Do not lean over open drums, vats, basins without using a safety line and/or harness. Sample bottles should be bagged prior to sampling to ease decontamination procedures. Be aware of emergency evacuation procedures and the location of all emergency equipment, including spill containment materials, prior to sampling. Practice contamination avoidance at all times. Utilize the buddy system and maintain communications with Command Post.

For lake sampling operations special precautions will be taken. It is anticipated that the facility utilized for sediment sampling in the lake will be a floating raft or similar craft. All aspects of stability should be considered prior to initiation of operations. In addition, all personnel must be able to swim and will be required to wear life jackets when offshore at all times. Communications will be maintained with the Command Post. Persons who will be handling samples must wear modified level C/D protection including chemical resistant gloves, splash protection, face shield or full-face respirator, etc., as specified by the H&S Supervisor.

10.3.3 Building Sampling

Prescribed clothing will be worn at all times. During building sampling, safety considerations will be given to the access of proposed sampling locations within the building. Such

considerations will include structural integrity of the access point and the evacuation procedures and routes out of the location. Safety harnesses will be used where the potential for falling exists, as well as during entrance to confined spaces where appropriate. Monitoring will be performed during sampling operations and communication with the Command Post maintained.

The buddy system will be utilized at all times. Attention will also be given to the potential to damage existing utilities, if any, and penetrating pipes or similar structures during invasive sampling techniques. Upgrading of protection levels will be employed when necessary, especially if any confined spaces must be entered or contaminates are present which cannot be read by the direct reading instruments or if especially toxic contaminants are present. Buildings will generally be sampled in Level C protection, however, downgrading may be appropriate when investigating occupied buildings and certified clean buildings for certain types of sampling provided sufficient supportive data exists. The Project H&S Officer will be consulted by the H&S Supervisor before significantly modifying any protection levels. Decon procedures will be employed before exiting one building and entering another. Sufficient light will be provided when conducting sampling operations in structures where no electric utilities are provided and insufficient natural light exists. Refer to Facility Information Sheet (see Appendix A) for specific details on the building to be entered.

10.3.4 Confined Space/Limited Egress Sampling

Sampling of Confined Space/Limited Egress (CS/LE) requires special safety considerations which are addressed in detail in Appendix G. Personnel required for a CS/LE operation include the H&S Supervisor, entry team, and standby personnel. Level B protection will normally be utilized but under certain conditions Level A protection may be required. The Facility Information sheet should be reviewed for further information about the CS/LE area. Before opening the entrance to a CS/LE area personnel will don respiratory and clothing protection.

Whenever possible samples will be obtained remotely from the surface and if the potential for falling exists, safety lines will be employed. Special consideration should be given to spill potential, residues under pressure, presence of flammable/combustible materials, and toxic contaminants. The buddy system will be maintained at all times. During all operations communications shall be maintained with the Command Post. Fully equipped backup teams will be on standby in the CRC in case of an incident. Emergency evacuation routes and safe areas will be established and emergency signals confirmed before operations commence. Health and Safety personnel must be alerted prior to initiation of sampling operations and will observe the team conducting the operation. Sampling teams will be fully aware of the location of all safety equipment and will be briefed as to use and other emergency procedures. Safety harnesses/lines will be used where appropriate.

10.3.5 Sampling Manholes

Manholes will be sampled using automatic sampling devices. The team will consist of the H&S Supervisor or Field Officer, a sampler and one support technician. Level B protection will be utilized unless the H&S Supervisor, with additional information available, alters this protection level. During all operations communications will be maintained with the Command Post. Personnel will don mask and suit prior to opening of the manhole cover. Samples will be obtained remotely from the surface and if the potential for falling exists, safety lines will be employed. If remote photography is utilized in manholes or similar structures, any associated lighting required must be intrinsically safe or the manhole must be fully cleared by the H&S Supervisor or Field Officer of the presence of combustible gases. Monitoring will be performed using the FID, PID, M-8 Alarm and Combustible Gas Indicator with other instrumentation utilized as indicated by the H&S Supervisor. Since the potential for high concentration of unknown contaminants exists, special caution should

be given to the handling of samples for dermal or respiratory hazard. Fully equipped backup teams will be on stand-by in the CRC in case of an incident. Emergency evacuation routes and safe areas will be established and emergency signals confirmed before operations commence. Sampling teams will be fully aware of the location of all safety equipment and will be briefed as to use and other emergency procedures. All observers and support personnel will remain at a safe distance upwind.

11.0 DECONTAMINATION PROCEDURES

11.1 Personnel and Equipment Decontamination Procedures

All personnel and equipment exiting the Exclusion Zone shall be thoroughly deconned through procedures implemented in the contamination reduction corridor (CRC). Figures 11.1-1 through 11.1-5 illustrate the sequence of steps for each level of protection which will provide for the removal and/or neutralization of contaminants. Modification of these procedures may be implemented by the H&S Supervisor, as appropriate. The decon line will employ open areas, partially enclosed areas and decon trailers as appropriate for each operation. All fluids produced will be collected and contained for appropriate disposal. All equipment shall be covered or bagged/contained in such a way as to allow for removal and disposal of the cover to provide decontamination. Decon solutions will consist of the use of one or more of the following: 10% sodium hydroxide, 5% sodium hypochlorite and detergent cleansing solution (e.g., sodium triphosphate). Under normal operations deconning with sodium triphosphate or equivalent is acceptable, however, when work has been conducted in areas suspected of having agent contamination or where confirmed, all three decon solutions will be utilized. Equipment employed will include a variety of drums, galvanized steel basins, long handle bristle brushes, plastic liner material, hand pump sprayers and benches. Attempts should be made to minimize cold stress and heat stress during decon operations. Personnel, e.g., technicians, will be available in the CRC to assist in decon operations.

When the presence of chemical agents has been verified by the H&S Supervisor all field personnel will initiate decontamination procedures. These procedures will be executed under the assumption that all personnel are contaminated. The procedures will be executed carefully and with the use of the neutralizing decon solutions described above. Appendix F of this HASP provides additional guidelines.

Figure 11.1-1

LEVEL A DECONTAMINATION PROCEDURES

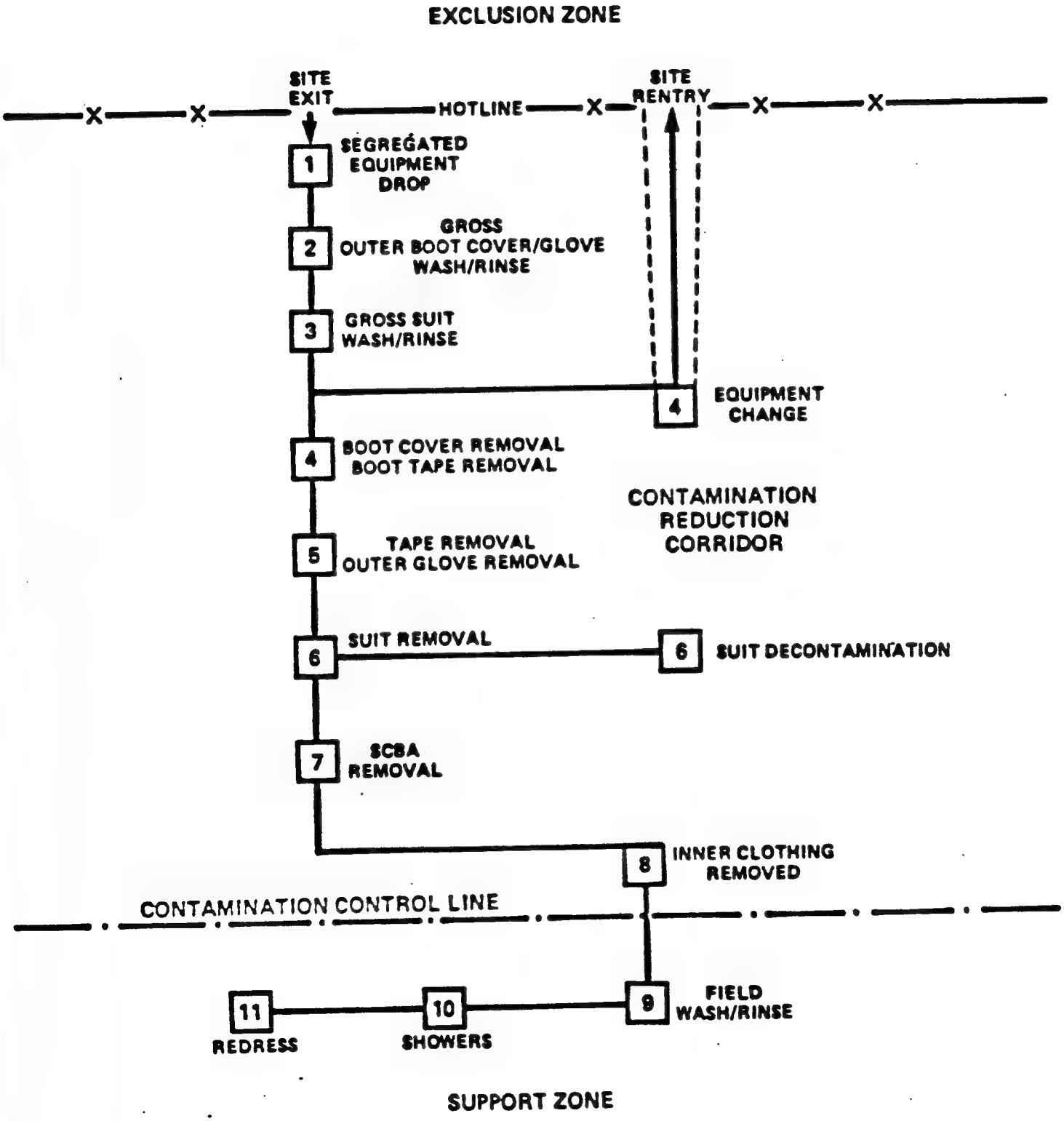


Figure 11.1-2

LEVEL B DECONTAMINATION PROCEDURES

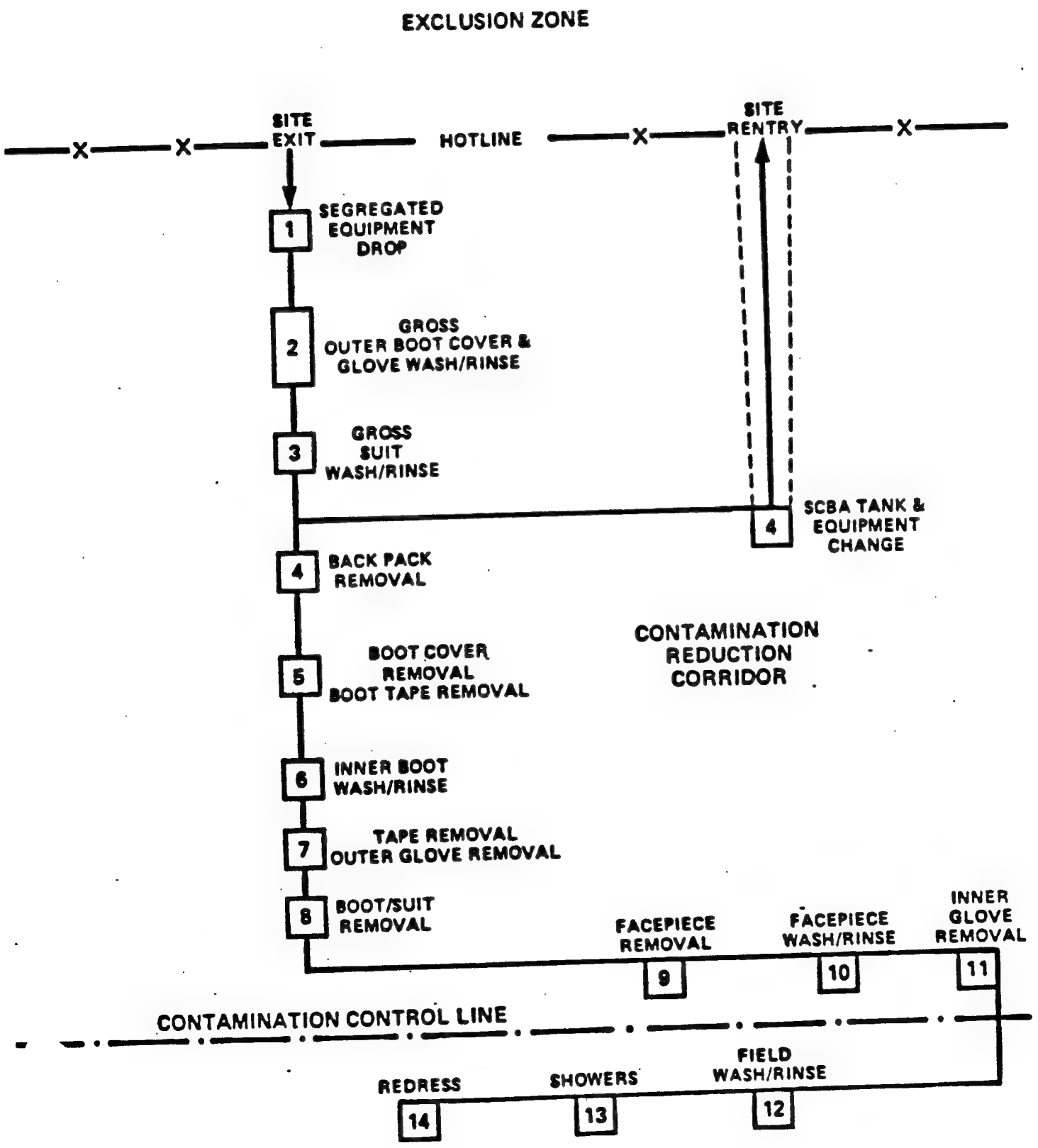


Figure 11.1-3

LEVEL C DECONTAMINATION PROCEDURES

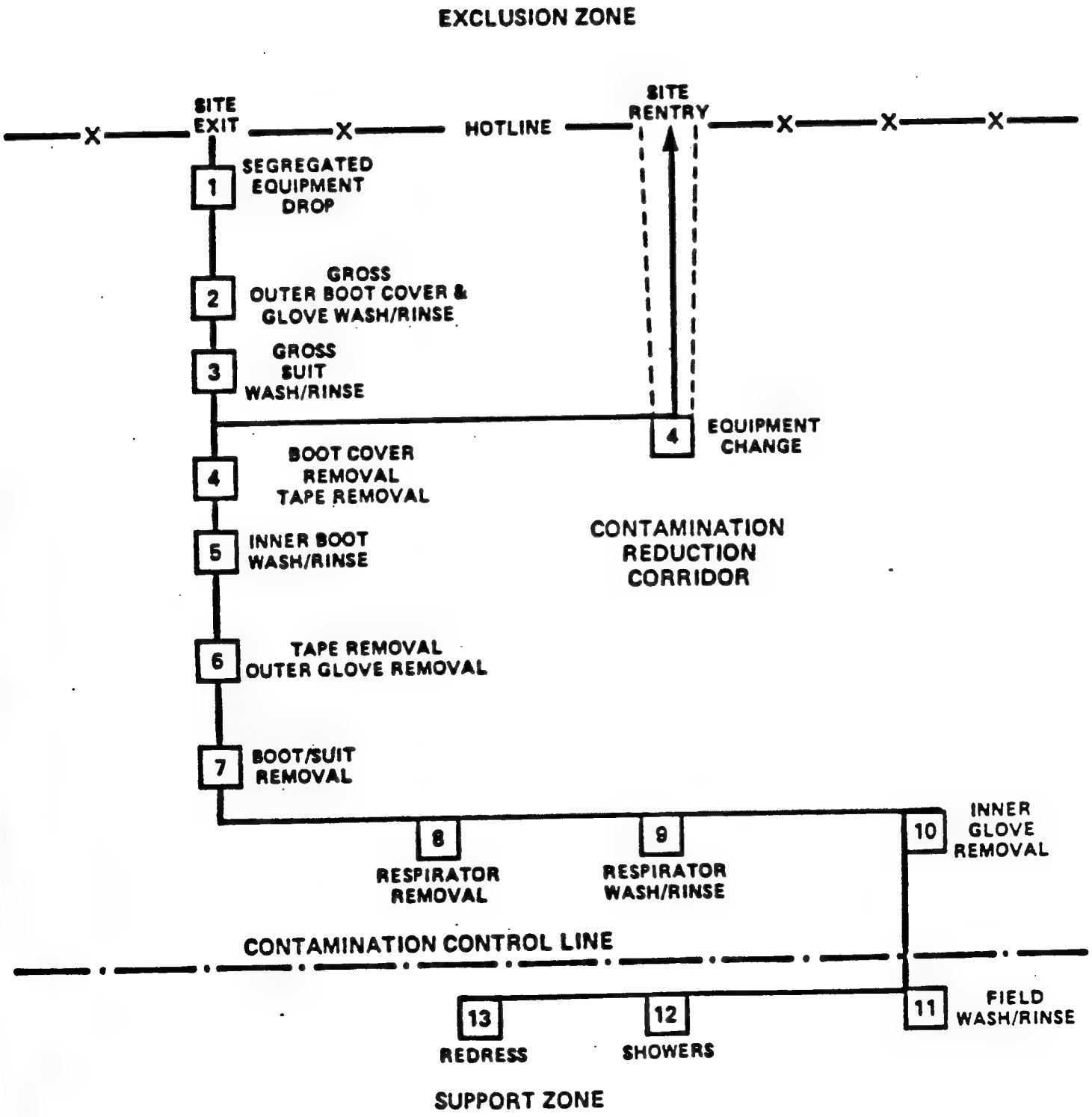


Figure 11.1-4

LEVEL C HEALTH AND SAFETY RECONNAISSANCE DECONTAMINATION PROCEDURES

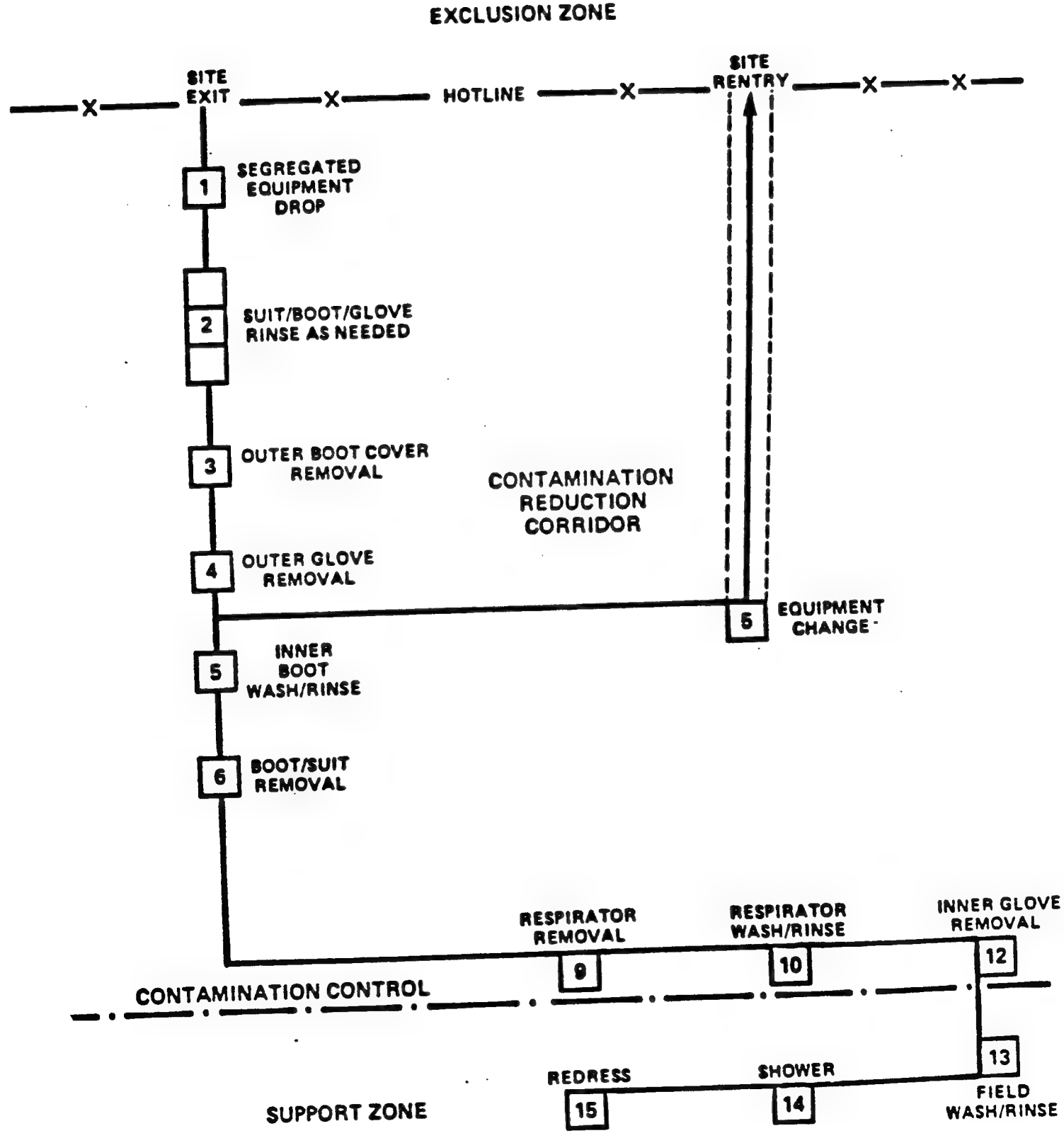
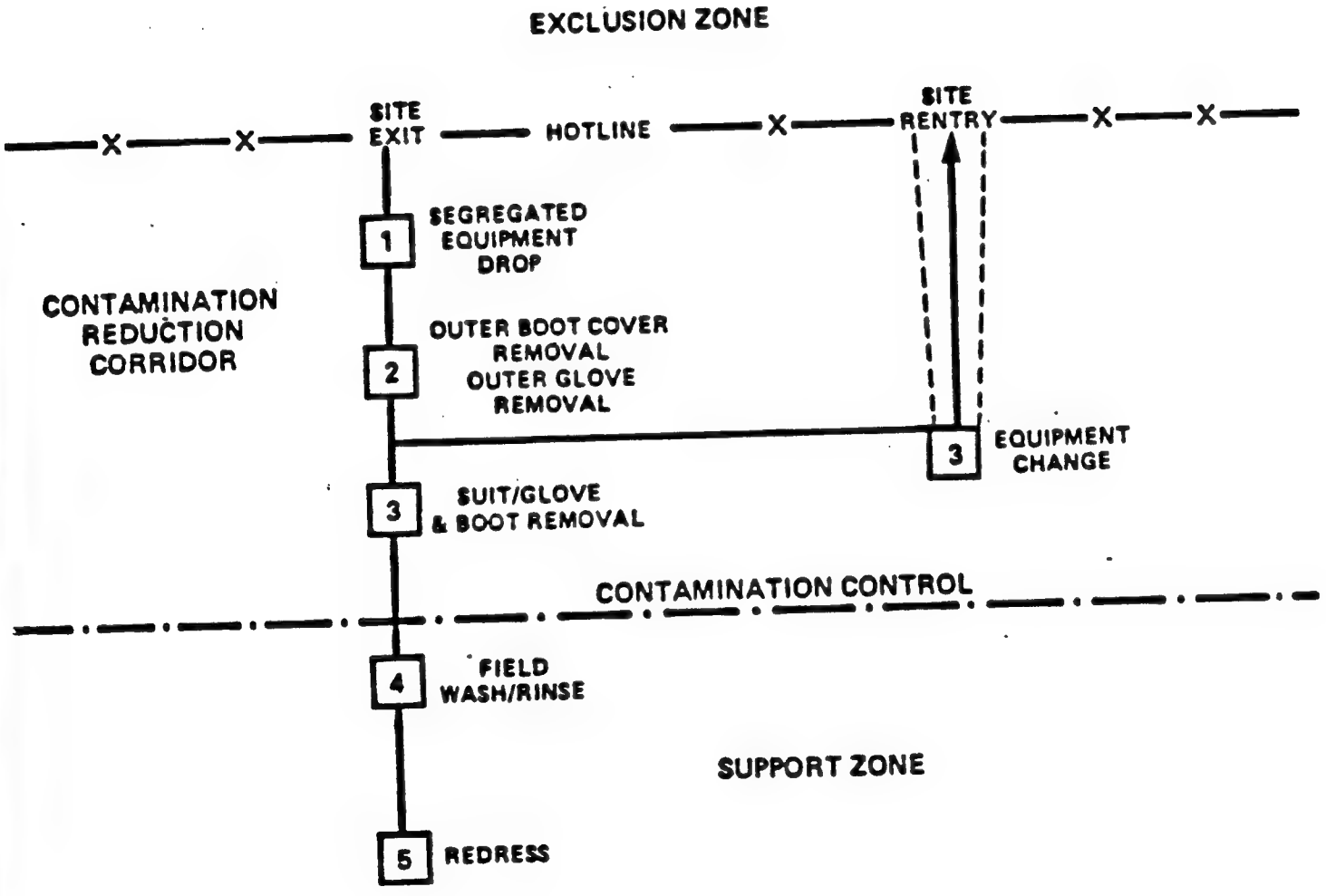


Figure 11.1-5

LEVEL D DECONTAMINATION PROCEDURES



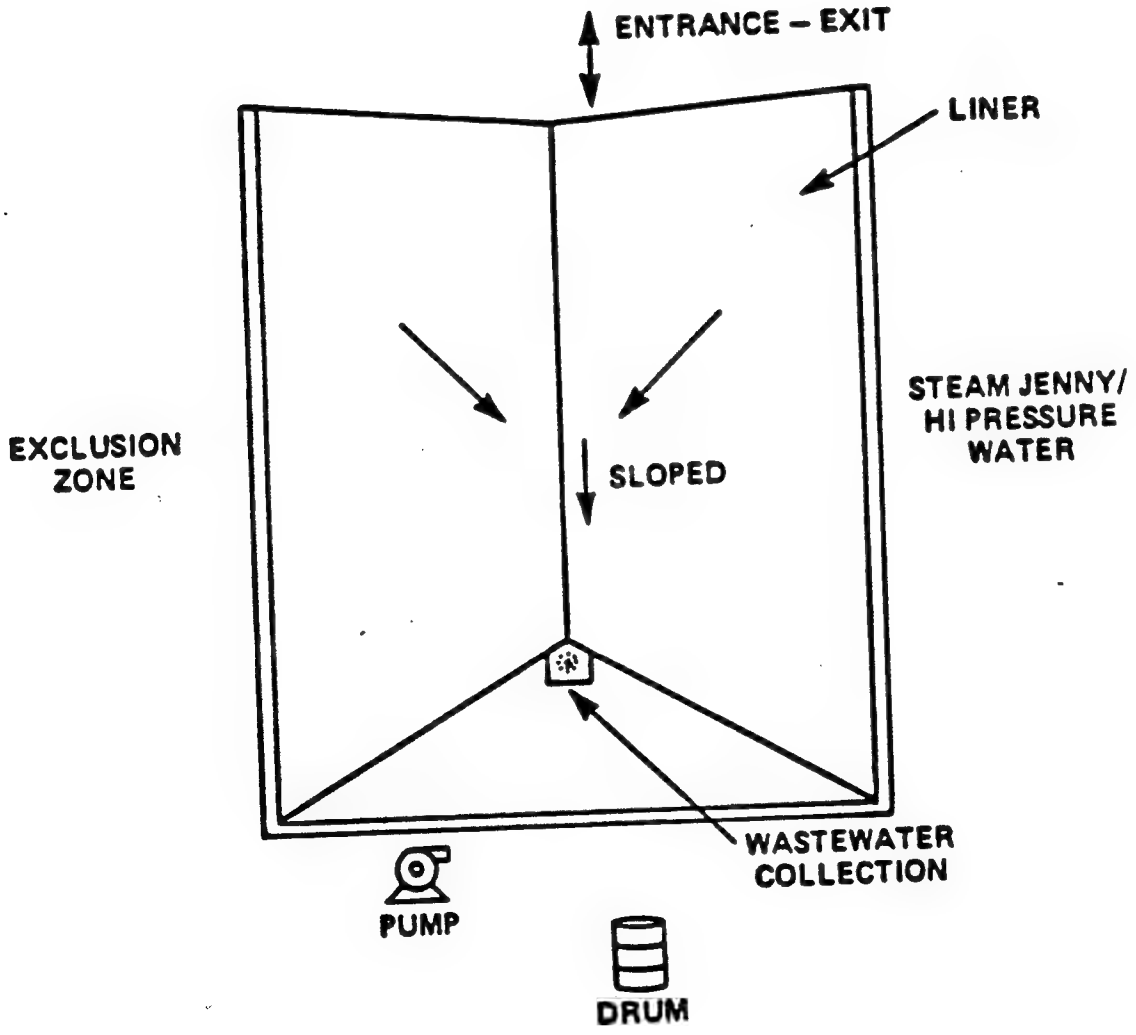
11.2 Heavy Equipment Decontamination Procedures

Heavy equipment decontamination will be performed using a steam generator in a specified area or a steam cleaning pit (see Figure 11.2-1) which will be sloped to collect washwater for subsequent containment and disposal. Steam cleaning operation should be placed in a remote area and downwind of personnel and other site operations. In addition, ongoing site operations should not impact steam cleaning activities. A portable decon pad and steam cleaner will be used where it is not possible to reach the permanent decon pad. For field decontamination of drilling equipment, e.g., augers, drill pipe, etc., all decon fluids and wastewaters will be collected and drummed for disposal. All equipment, samples, and vehicles will be fully decontaminated before leaving the project site. Solid materials produced during drilling operations will be effectively covered to prevent becoming airborne. When analysis of core samples is made available, these materials will be drummed if contaminated.

Personnel responsible for steam cleaning shall use Level C protective equipment and employ the buddy system. This area is restricted to all personnel. Special consideration should be given to wind speed and direction and downwind areas should be kept free of personnel in order to avoid potential airborne contamination.

Figure 11.2-1

HEAVY EQUIPMENT DECONTAMINATION



12.0 ADDITIONAL SAFE WORK PRACTICES

12.1 Description of Additional Health and Safety Practices not Previously Specified

Refer to H&S personnel for specific concerns for each individual site task. Do not climb over/under trailers, drums, pipes, vats, basins or other obstacles and always employ buddy system. Emergency phone numbers will be posted in the Command Post. All trailers should be secured using wheel chocks and other suitable means. Become familiar with the warning properties of some of the chemical agents at RMA which are presented in Appendix E. Practice contamination avoidance and plan activities ahead of time with caution in regard to concurrently running activities. Also, due to the unknown location of chemical agents and unexploded ordnance, caution should be practiced during all onsite activities. Apply first aid to any and all open cuts, scratches, abrasions, etc. immediately. Be alert to your own physical condition and watch your buddy for signs of fatigue, exposure, etc. A work/rest regime will be initiated when ambient temperatures and protective clothing create a potential heat and cold stress situation. Task safety briefings will be held prior to onset of task work. Know your Health and Safety Plan.

13.0 DISPOSAL PROCEDURES

13.1 Disposal Procedures

All discarded materials, waste materials or other objects will be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left onsite. All noncontaminated materials will be collected and bagged for appropriate disposal as normal domestic waste.

All disposable protective clothing, gloves, boots, suits, cartridges, etc., will be bagged and drummed. Contaminated washwater and other contaminated materials will be collected and stored in drums. Excavated solid materials will be left on the ground and covered following drilling operations with grouting material, plastic liner or other suitable material that will prevent these materials from becoming windborne. When data on the core samples becomes available these materials will be drummed for disposal if contaminated. Drums used for disposal of contaminated materials and liquids will be properly labelled and secured. Storage of these drums will be in a manner which will facilitate removal and easy handling. Any materials used to cover equipment (e.g., monitoring equipment) will be discarded as with the disposal of protective suits (i.e., TYVEK suits).

14.0 EMERGENCY/CONTINGENCY PLANS

14.1 Emergency Contingency Procedures

The emergency/contingency procedures provided below will be posted in the Command Post where communications will be provided. The first phone number listed for each event should be utilized if that situation arises, other numbers are provided as backup. In general, the Fire Department will be contacted first. The Chemical Action and Incident Control Office (CAICO) should also be contacted if an event occurs. These procedures are subject to modification in order to be consistent with RMA plans currently being developed by CAICO. Each day, before operations commence, the H&S Supervisor will provide the Fire Department with a copy of the safety briefing which will include a description of the intended activities. He will also identify the location of planned operations for that day on a map provided by the Fire Department.

14.1.1 Mitigation Procedures for Overt Personnel Exposure

Skin Contact: Use copious amounts of soap and water. Wash/rinse affected area for at least 15 min. Decon and provide appropriate medical attention. Eyewash and emergency showers will be provided onsite.

Inhalation: Move to fresh air and/or, if necessary decon/transport for medical attention.

Ingestion: Decon/transport to hospital.

Innoculation: Decon, transport for professional medical attention at hospital.

Fire Dept - (303) 289-0223
Ambulance - (303) 289-0223
RMA CAICO - (303) 289-0141
Presbyterian Aurora Hospital - (303) 360-3133

14.1.2 Personnel Injury Procedures

Apply emergency first aid onsite as deemed necessary. Several individuals trained in First Aid will be onsite during all operations. Decon and transport individual by the Fire Department to the hospital if needed. H&S Supervisor will supply medical data sheets to appropriate medical personnel as requested and complete US Army injury reports DA 285 and DA 1051 (see Appendix D) if required. The H&S Supervisor will notify the Project H&S Officer and Project Manager of any injury or exposure.

Fire Department - (303) 289-0223
Ambulance - (303) 289-0223
RMA CAICO - (303) 289-0141
Presbyterian Aurora Hospital - (303) 360-3133
Rose Medical Clinic - (303) 298-0891
Project Manager (J. Silvey) - (714) 662-4049
Project H&S Officer (L. Niemiec) - (303) 988-2202

14.1.3 Fire or Explosion Procedures

Evacuate area immediately (air horn will sound for 10 second intervals) - Notify onsite RMA Fire and Security departments and other appropriate emergency response groups if Lower Explosive Limit (LEL) valves are above 25% in ambient air or if UXO is encountered. Fire phones are located near most buildings and will be identified before operations commence. Suspend operations and evacuate area if borehole measurements exceed 50% LEL.

RMA Fire Department - (303) 289-0223
RMA CAICO - (303) 289-0141
RMA Safety Office - (303) 289-0338
RMA Security Office - (303) 289-0367

14.1.4 Chemical Agent Exposure Procedures

Immediately evacuate area and stop all operations. Notify RMA Fire Department as soon as possible. All subsequent contacts will be made by them. The Fire Department will provide transport of exposed personnel to the Hospital. The H&S Supervisor will complete the Contractor Report Form provided in Appendix F, Figure 5-1. All personnel will initiate decon procedures as described in Section 11.0.

RMA Fire Department - (303) 289-0223
RMA Tech Escort - (303) 289-0152
RMA CAICO - (303) 289-0141
RMA Safety Office - (303) 289-0338

14.1.5 Discovery of Unexploded Ordinance (UXO) Procedures:

Immediately evacuate area and cease operations. Notify CAICO and other appropriate onsite RMA personnel as the situation requires.

RMA Tech Escort - (303) 289-0152
RMA CAICO - (303) 289-0141
RMA Fire Department - (303) 289-0223

14.1.6 Environmental Incident (Spread of Contamination) Procedures

Secure spread of contamination if possible. Downrange personnel will notify the H&S Supervisor who will contact CAICO and the Sampling Team Supervisor. Other appropriate emergency response groups will be notified as necessary.

RMA CAICO - (303) 289-0141
RMA Tech Escort - (303) 289-0152
RMA Fire Department - (303) 289-0223

14.1.7 Adverse Weather Conditions

In the event of adverse weather conditions, the H&S Supervisor will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered by the H&S Supervisor prior to determining if work should continue are:

- Potential for heat stress
- Potential for cold stress and cold related injuries
- Treacherous weather-related working conditions
- Limited visibility
- Potential for electrical storms

14.1.8 Incident or Near Miss Accident Procedures

When an incident occurs the H&S Supervisor will notify the Project H&S Officer and Project Manager of the event. Actions will then be taken to correct the event which caused the incident.

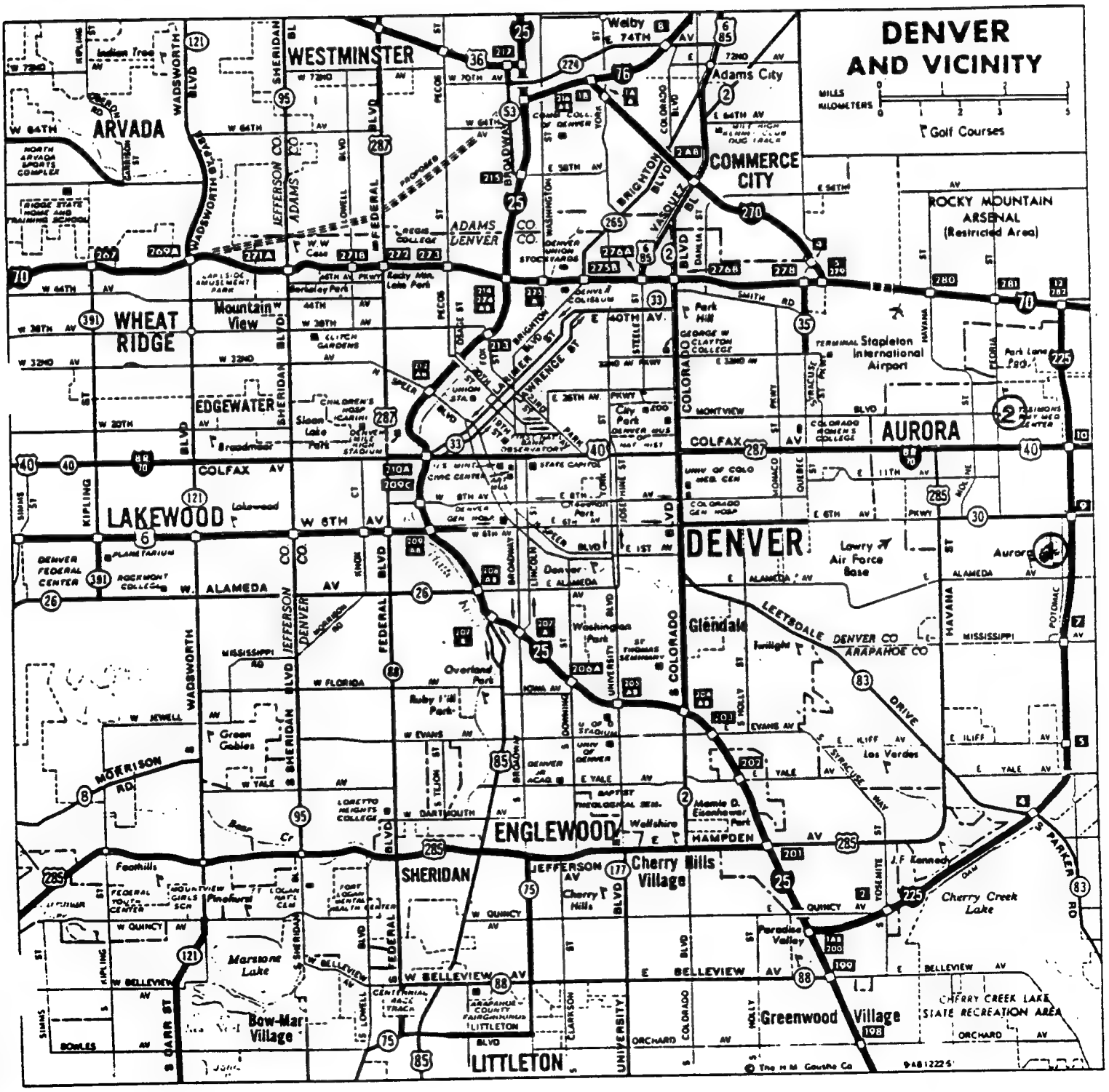
Project H&S Officer (L. Niemiec) - (303) 998-2202
Project Manager (J. Silvey) - (714) 662-4049

14.2 Hospital Routes

HOSPITAL: Call Fire Department at (303) 289-0223 which will provide ambulance service and/or transportation to the Presbyterian Aurora Hospital. Backup procedure is transportation of injured personnel by Reed Ambulance Service (303) 758-1333, Airlife Helicopter (303) 360-3250 or site team to Fitzsimons Hospital (See Figure 14.2-1).

Figure 14.2-1

Hospital Locations



1. Presbyterian Aurora Hospital - Starting at Fire House (Bldg. 312) at corner of D Street and December 7th Avenue proceed west on 7th to C Street (1 mile) make left on C Street (south) and go to gate (2 miles) go through gate and make left onto 56th Ave (east, 2 miles) make right on Peoria (south), go 4 miles turn left on Colfax Avenue (east) and proceed 0.9 miles. Make right by Holiday Inn (sign says Potomac Street) proceed 0.9 miles, hospital is on left, emergency entrance is on south side of hospital on Potomac Street.

2. Fitzsimons Hospital - Starting at Fire House (Bldg. 312) at corner of D Street and December 7th Avenue proceed west on 7th to C Street (1 mile) make left on C Street (south) and go to gate (2 miles) go through gate and make left onto 56th Ave (east, 2 miles) make right on Peoria (south), go 3.5 miles. Hospital is on left, gate entrance is at Montview and Peoria. Enter through gate and follow orange code onsite to Emergency Center (Bldg T500).

14.3 Evacuation Procedures

In the event of an emergency situation during recon or sampling operations, such as fire, explosion, significant release of toxic gases, etc., an air horn will be sounded for approximately 10 seconds indicating the initiation of evacuation procedures. All field personnel in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone trailer or other safe area as identified by the H&S Supervisor onsite. The location should be upwind of the situation as determined by the wind direction. Once the safety of all field personnel is established, RMA CAICO (303) 289-0194, RMA Fire Dept. (303) 289-0223 and Security (303) 289-0367 will be notified by telephone of the emergency. When making the report to security describe the complete situation including, when possible, the following:

- o Time and location of emergency
- o Is an explosion or fire involved?
- o Type of Agent involved. Agent released?
- o Are there casualties, intruders or hostages?
- o Estimated wind speed and directions.

In the event of an emergency onsite causing the RMA Chemical Accident and Incident Control Plan to be implemented, the following audible signals will be used.

EMERGENCY OR EXERCISE SIGNAL: A steady, 30 to 45 second tone on the emergency siren. This signal may be used to indicate an actual emergency, such as a major fire, an explosion, or toxicant release; or, it may be used to indicate that an exercise of the RMA CAIC Plan is being conducted.

Two other audible emergency signals, which conform to those established by the Federal Emergency Management Agency, are utilized at RMA as follows (See also Figure 14.3-1):

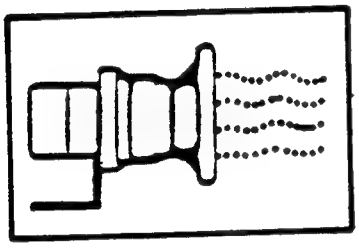
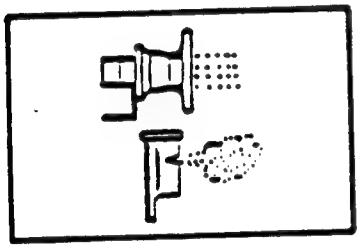
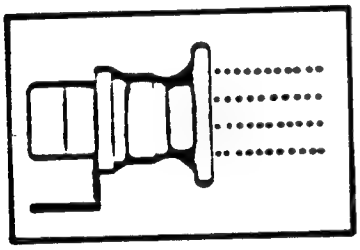
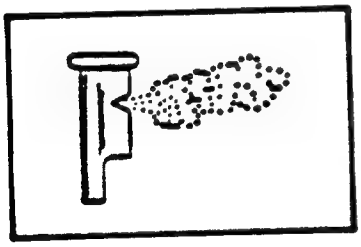
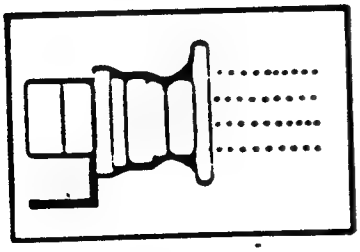
1. ATTACK WARNING SIGNAL. A 3 to 5 minute, wavering tone on emergency sirens. The ATTACK WARNING signal means that an actual attack against the country has been detected and protective action shall be taken. Proceed to shelter in Building 732* immediately and bring protective mask. THIS SIGNAL WILL NOT BE USED FOR ANY OTHER PURPOSE AND WILL HAVE NO OTHER MEANING!

---

* To proceed to Building 732, leave the South Plants Area by heading North to Dec. 7th Ave. Turn right (east) and go down Dec. 7th Ave. past the large storage tanks located on both sides of the road. Upon passing the tanks on the right or south side of Dec. 7th Avenue make a right turn and proceed south on roadway. Upon passing the first building on the left, make a left turn and go to the east end of this building for entrance.

Figure 14.3-1

EMERGENCY ALARMS

SIGNAL	EMERGENCY	ACTION
 OSCILLATING SIREN 3 TO 5 MINUTE INTERVAL	ACTUAL ATTACK	GO TO BLDG 732 TAKE MASK
 STEADY SIREN & INTERMITTENT WHISTLE 3 TO 5 MINUTE INTERVAL	FIRE, EXPLOSION OR TOXICANT	EVACUATE PLANTS AREA UPWIND WEAR MASK
 INTERMITTENT SIREN 30 TO 45 SECOND INTERVAL	FIRE, EXPLOSION OR TOXICANT (RMA)	AWAIT ADVICE
 INTERMITTENT WHISTLE 15 SECOND INTERVAL	FIRE, EXPLOSION OR TOXICANT (SCC)	AWAIT ADVICE
 STEADY SIREN 3 TO 5 MINUTE INTERVAL	ALERT	AWAIT ADVICE

2. ATTENTION or ALERT Signal. A 3 to 5 minute, steady tone on sirens, horns, or other devices. This signal may be used for any peacetime emergency, e.g., tornadoes, floods, etc., in which the local Commander desires to alert installation personnel to prepare to receive essential information through local media such as public address systems, telephone, or radio.

15.0 AUTHORIZATIONS

Personnel authorized to enter downrange areas while Ebasco is conducting field operations must be certified by the Project Manager and the H&S Officer. Authorization will involve completion of appropriate training courses, medical examination requirements, and review of this HASP. A waiver system for non-Ebasco personnel, evaluated by the Project Manager, may be employed which will also provide authorization. In either case, all personnel must utilize the buddy system or trained escort, and check in with the Site Manager and the H&S Supervisor at the Command Post.

EBASCO TEAM PERSONNEL AUTHORIZED TO PERFORM WORK ON-SITE (Downrange)

ENVIROSPHERE - DENVER

C. Bieniulis
E. Aguado
T. Canon
J. Coen
C. Crosson
*D. Gabel
W. Johnson
J. Kerr
R. Lytle
K. Mahmood
N. Martin
K. Mitchell
D. Morrell
L. Niemiec
R. Petrella
*T. Ristau
T. Sindelar
J. Tate

ENVIROSPHERE - SACRAMENTO

*R. Mahmood

ENVIROSPHERE - LYNDHURST

E. Aguado
B. Bliss
B. Groves
L. Horgan

ENVIROSPHERE - ATLANTA

M. Bilello

ENVIROSPHERE - DALLAS

*H. Harbert

EBASCO TEAM PERSONNEL AUTHORIZED TO PERFORM WORK ON-SITE (Downrange)
(Continued)

ENVIROSPHERE - DENVER

P. White

ENVIROSPHERE - SANTA ANA

S. Anderson

ENVIROSPHERE - SEATTLE

P. Chiaro
J. McCourt
*D. Tillman

CUSTOM AUGER

R. Ager
M. Baker
S. Brown
C. Castaneda
F. Jayne
F. Parks
A. Rodriguez
F. Spencer
M. Treat
E. Wieberg

ARROW DRILLING

J. Berglund
Paul Berglund
Peter Berglund
T. R. High

ENVIROSPHERE - SACRAMENTO

STOLLAR & ASSOCIATES

K. Knirsch
F. Lowman
B. Myller
C. Senz
E. Sopher
D. Zigich

PHOENIX SAFETY

T. Bernardi
A. Federoff
D. Wolski

TECHNOS

E. Alzola
M. Turner
E. Yuhr

* Need updated physical or additional training before going downrange.

EBASCO TEAM PERSONNEL AUTHORIZED TO PERFORM WORK ON-SITE (Downrange)
(Continued)

GERAGHTY & MILLER

*G. Bradbeer
B. Grundl
*C. Senz
*R. Sipe
*M. Smith
*D. Swanson
E. Windesheim

* Need updated physical or additional training before going downrange.

OTHER PERSONNEL AUTHORIZED TO ENTER SITE

ENVIROSPHERE - DENVER

J. Keithley
R. Lo
R. Lytle

ENVIROSPHERE - SANTA ANA

M. Marusich
L. Moussavian
D. Rusciolelli
C. Russ
J. Silvey
M. Williams

ENVIROSPHERE - SEATTLE

J. Butts
K. Johnson
D. Martin
G. Mattson
S. Pavlou
A. Rossi
C. Schrader
M. Schultz
S. Walden

ENVIROSPHERE - SACRAMENTO

A. Sarkar

ENVIROSPHERE - LYNDHURST

N. Camp
J. Farris
A. Patterson
R. Patterson

STOLLAR & ASSOCIATES

T. Chandler
S. Garcia
C. Schmitt

CUSTOM AUGER

J. Bray
J. Laskey

I-TECH

W. Burke
J. Crabtree
W. Groehn
R. Jones

OTHER PERSONNEL AUTHORIZED TO ENTER SITE
(Continued)

TRACER
O. Evans
L. Lawlor
G. Thompson

GERAGHTY & MILLER
A. Barber

ARROW DRILLING
T. H. High

USATHAMA
K. Blose
D. Campbell
J. Ricci
C. Sharmin

STEARNS
E. Brown
M. Pervich
B. Wrenshaw

ESE
S. Spencer

HITTMAN-EBASCO
C. Weathington

16.0 MEDICAL DATA SHEET

This brief Medical Data Sheet will be completed by all onsite personnel and will be kept in the Command Post during the conduct of site operations. It is in no way a substitute for the Medical Surveillance Program requirements consistent with the Ebasco Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance is required or if transport to hospital facilities is required.

Project Rocky Mountain Arsenal

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

In case of emergency call _____

Allergies _____

Particular Sensitivities _____

Do You Wear Contacts? _____

Provide a Checklist of Previous Illnesses or Exposures to Hazardous Chemicals _____

_____

_____

What medications are you presently using? _____

_____

_____

Do you have any particular medical restrictions? _____

Name of Personal Physician _____ Telephone _____

17.0 FIELD TEAM REVIEW

FIELD TEAM REVIEW

I have read and reviewed the Site-Specific Health and Safety Plan and understand the information contained therein and will comply.

Name: _____

Signature: _____

Date: _____

Site/Project: Rocky Mountain Arsenal

18.0 APPROVALS

By their signature, following, the undersigned certify that this Health and Safety Plan will be utilized for the protection of the health and safety of workers at Rocky Mountain Arsenal.

Health and Safety Officer	_____	_____ Date
Technical Manager	_____	_____ Date
Project Manager	_____	_____ Date
Manager, Health and Safety	_____	_____ Date
Regional Vice President	_____	_____ Date

APPENDIX A

FACILITY INFORMATION SHEET

APPENDIX A

Facility Information Sheet

SAMPLING SITE

Type:

Location:

Size:

DESCRIPTION

Construction/Terrain:

Structural Integrity:

Entrance:

Egress:

Facilities/Utilities:

HISTORY

Current Status:

Previous Use:

Potential Contamination:

Facility Information Sheet (Continued)

HEALTH AND SAFETY

Safety Zones:

Emergency Evacuation:

Protection Level:

Reconnaissance:

Field Sampling:

Obstacles/Physical Hazards:

REMARKS

APPENDIX B

PARTIAL LIST OF SPILLS BY LESSEE AT ROCKY MOUNTAIN ARSENAL

MATERIAL	SPILL NUMBER	DATE	QUAN. GALLONS	LOCATION	COMMENTS
Acetic acid	12	1952-70	b/	N Bldg. 516	Leaking Sewer Line
Acetone	24	9/79	500	Bldg. 514 Tank Farm	
	40				
Aldrin	1	ca 1952	1,500	NW Bldg. 422	Removed solidified aldrin
	2	ca 1952	16,000	W Bldg. 413	" " "
	6	2/51	10,000	E Bldg. 422	
	8	1950-74	b/	Ditch to Sand Creek Lateral	Water seepage to ditch
	12				Leaking Sewer Line
ALDRITE Insecticide	8	1969-74	b/	Ditch to Sand Creek Lateral	Water seepage to ditch
Allyl chloride	59	2/15/72	100	S Bldg. 471	
	16	6/76	550	S Bldg. 471	
	61	1/13/75	2,138	N Bldg. 471	Trapped in ditch and some recovered
AZODRIN Insecticide	5	1966	1,000	NW room Bldg. 514	
	40	1963-81	b/	N Dock, Bldg. 514	Periodic washing of drum facilities
	54	1974	55	SE Bldg. 451	Dirt removed.

b/ Greater than 55 gallons; total quantity impractical to estimate.

c/ Date leak started is unknown.

...TERIAL	SPILL NUMBER	DATE	QUANTITY ...NS	LOCATION	COMMENTS
Bicycloheptadiene (BCH)	6				Water seepage to ditch
	8			E Bldg. 424A	
	22	1960	200	Bldg. 471	
	23	1950-81	b/	Tank Farm	
BCH bottoms	60	9/78	50,864	S Tank Farm	Mixed with No. 6 Fuel Oil
	66	2/56	1,400	T-4648	
Benzene	1				See Aldrin
	2				See Aldrin
	3	1951-53	16,000	S of Bldg. 522A	
	12				See Acetic Acid
	23				
	63	12/57	3,000	N Bldg. 515	
Caustic soda, 20%w	12				See Acetic Acid
	25	1978	500	N Bldg. 514	Removed dirt and replaced
	25a	-1981 c/	b/	N Bldg. 514	
	33	1969	900	Plant Area	
	58	12/29/71	7,400	N Bldg. 514	
Caustic soda, 50%w	32	1965	200	N Bldg. 514	
Chloroform	40				See Azodrin
	55	6/1/76	960	NE Bldg. 514	
Chlorothiophenol (CTP)	31	1967	500	NW Bldg. 512	Likely cleaned up - bad odor

b/Greater than 55 gallons; total quantity impractical to estimate.

c/Date leak started is unknown.

MATERIAL	SPILL NUMBER	DATE	QUANTITY GALLONS	LOCATION	COMMENTS
Compound 773	15 15a				
Cyclopentadiene (CPD)	28	1949-74	500	N Bldg. 521	
CPD bottoms	64	12/58	650	E Bldg. 525	
CPD dimer (DCPD)	9	1973	55	S Bldg. 433	
	28 37	1953	200	Trenches, Section 36	
	42	1949-74	b/	S Bldg. 528	
	65	9/63	1,700	N Bldg. 514	
DCPD bottoms	20	1967	1,500	T-464A	Mixed with No. 6 Fuel Oil
	56	8/8/76	1,548	S Tank Farm	" " " " " "
D-D Soil Fumigant	36	ca 1971	100	SE Bldg. 433	
	50	1975	250	S Bldg. 433	Dirt removed from ditch
Dieldrin	12				See Acetic Acid
Dinitrochlorothiophenol (SD 11829)	46	1/1/75	400	Around Bldg. 534	
Endrin	12				See Acetic Acid
Fuel Oil (No. 6)	20				See DPCD bottoms
	56				" " "
	60				See BCH bottoms
Heptane	38	1949	2,000	N Bldg. 534B	

b/Greater than 55 gallons; total quantity impractical to estimate.

c/Date leak started is unknown.

MATERIAL	SPILL NUMBER	DATE	QUANTITY GAL.	LOCATION	COMMENTS
Hexachlorocyclopentadiene (Hex) (HCCPD)	6				See Aldrin
	8 14	1949-55	b/	N Bldg. 516	
	27	1953-64	1,500	Around Bldg. 512	Removed some and covered with soda ash
	29	1949-55	200	NE Bldg. 521	
	39	ca 1960	150	Near Flare-North Plant area.	
	15	1953-64	100	E Bldg. 512	
Hexane	41	1958	1,200	N Bldg. 511	
	43	1974	1,000	E Bldg. 534	
Isopropanol	15a	1953-64	400	Around Bldg. 512	
Mineral spirits	8				See Aldrin
	62	4/24/75	300	N Bldg. 471	
Mixed acid	46 47	1969	100	N Bldg. 534A	
Naled (DIBROM)	11	1964	200	S Bldg. 254	
NEMAGON Soil Fumigant (DBCP)	8				See Aldrin
	10	11/13/73	1,100	N Bldg. 471	Replaced dirt in entire area
	51	1973	60	S Bldg. 347	
	57	11/10/71	93	N Bldg. 471	

b/Greater than 55 gallons; total quantity impractical to estimate.

c/Date leak started is unknown.

MATERIAL	SPILL NUMBER	DATE	QUANTITY GALLONS	LOCATION	COMMENTS
Spent acid	34	1973	100	SW of E Gas Holder	
	35	1973	100	W Bldg. 422	
	52	1967-75	b/	T-464A	
Sulfuryl chloride	45	1958	200	Bldg. 528	
	49	1978	100	Near Flare-North Plant area.	
Trimethyl phosphite (TMP)	44	1970	3,000	N Bldg. 514	Removed dirt to depth of 2-3 fe
Toluene	4	1955	1,000	N Bldg. 514	
VAPONA Insecticide (Dichlorvos)	23	1960-80	200	S Bldg. 471	
Xylene	8				See Aldrin
	12				See Acetic Acid

b/Greater than 55 gallons; total quantity impractical to estimate.

c/Date leak started is unknown.

APPENDIX C

CHEMICALS KNOWN TO HAVE BEEN PRESENT AT RMA

etaldoxime

etic Acid

etone

etone Cyanohydrin

etylene

rosol OT-100%

TON* Insecticide Phosphorothioic acid,0-[2,5-(dichlorophenyl) vinyl] 0,0-diethyl ester

drin Hexachlorohexahydro-endo, exo-dimethanonaphthalene (principal constituent, known as HHDN)

izarin Cyanone green dye

lyl Chloride

num

luminum Chloride

luminum Compounds

luminum Hydroxide

luminum Oxide

-Amino-iso-butyronitrile

mmonia

mmonium Chloride

ntimony

rsenic (including following As compounds)

rsenic Compounds

rsenic Oxide

nic Salts

rsenic Trichloride

rsenic Trioxide

senious Chloride	
razine Herbicide	2-chloro-4-ethylamino-6-isopropylamino-s-triamine
taclay	
ZODRIN* Insecticide	Dimethyl phosphate of 3-hydroxy-N-methyl cis-crotonamine
zodrin Related Salts	
arium	
entonite HPM 20	
enzaldehyde	
enzene	
enzol	
othiazole	
eryllium	
icarbonate	
icycloheptadiene	
BIDRIN* Insecticide	3-(dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide
Bis(diisopropylaminoethyl)disulfide	
Bis(diisopropylaminoethyl)sulfide	
Bismuth	
BLADEX* Herbicide	2-(4-chloro-6-ethylamino-s-triazin-2-ylamino)-2-methylpropionitrile
Boron	
Boron Compounds	
ax	
omine	
Bromine Chloride	

ı-bromobenzaldehyde

Butylphthalylbutylglycolate

Cadmium

Cadmium Compounds

Calcium

Calcium Bicarbonate

alcium salts

Calcium Carbide

Calcium Chloride

Calcium Hydroxide

Calcium Hypochlorite

Carbon Tetrachloride

bonate

Carbonyl Chloride

Caustic

Chloral

Chlorate

Chlorate Salts

Chlordane

Chlordene

~~Chloride~~ See Sodium Chloride

~~Chloride Salts~~

Chlorine

Chlorinated Paraffins

lorinated Phenol

hloroacetaldoxime

Chloroacetyl Chloride

lorobenzene

-Chlorobenzenethiol

loroform

-chloro-N,N-dimethylacetoacetamide

-chloro-3,5-dinitrophenyl methyl sulfone

-chloroisophorone

(p-chlorophenyl)-3-methylbutyric acid

-Chlorophenylmethyl Sulfide

-Chlorophenylmethyl Sulfone

-Chlorophenylmethyl Sulfoxide

-Chlorovinylarsenic Acid

ium

hromium Compounds

IODRIN* Insecticide Alpha-methylbenzyl 3-(dimethozyphosphinyloxy)-cis-crotonate

Cobalt

Cobalt Compounds

Copper

Copper Compounds

Copper Sulfate

Cyanide

Cyanogen Chloride

2(1'-cyano-1'-methyl-ethylamino)4,6-dichloro-s-triazine

Cyanuric Chloride

lopentadiene

DDE

)DT

)iazinon

)IBROM 1,2-Dibromo-2,2-Dichloroethyl Dimethylphosphate

1,2-Dibromo-3-Chloropropane

)ichloroacetyl Chloride

)ichlorobenzene

)ichloroethane

)ichloroethylene

5.7-Dichloro-2-Methyl Benzofuran

)icyclohexylphthalate

)icyclopentadiene

drin Hexachloroepoxyoctahydro-endo,exo-dimethanonaphthalene (principal constituent, known as HEOD)

)iethyldimethyldiphosphonate

0,0-diethyl phosphorochloridothionate

)i(2-ethylhexyl)phthalate

)iisobutylphthalate

)iisopropylaminoethanethiol

)iisopropylaminoethanol

)iisopropylaminoethylmethylphosphonothioate

N,N-)iisopropylcarbodiimide

)iisopropyldimethyldiphosphonate

)iisopropylmethyl Phosphonate

)iketene

N-)imethylacetoacetamide

)imethylamine

:methyl Hydrazine

imethyl methyl Phosphonate

i-n-butylphthalate

-Dinitrobenzene

ipropyl Amine

i-n-propylamine

ioctyladipate

ioctylphthalate

ipotassium acid phosphate

ithiane

ursban

phogene BC-720

...drin Hexachloroepoxyoctahydro-endo,endo-dimethanonaphthalene

:TAC $C_4H_{10}O_2SPCl$

:thyl Alcohol

Ethylamine

Ethyl benzene

Ethylene Glycol

Ethylene Glycol Monoethyl Ether

Ethylmethyl-phosphonate

O-Ethylmethylphosphonothioate

Ethyl parathion O,O-diethyl O-p-nitrophenyl thiophosphate

Ethyl parathion related salts

Farnesol

F :hion

:oride -- See Sodium Fluoride

~~Fluoride Salts~~

Formaldehyde

Freon 113

Fuel Oil #6

GARDONA* Insecticide 2-chloro-1-(2,4,5-thrichlorophenyl) vinyl dimethyl phosphate (MP 98° C, SD-8447)

Gasoline, Grades 4 & 5

Gasoline, Unleaded

Gold

Heavy Aromatic Naphtha

Heptachlor

Heptachlor Epoxide

1,2,3,4,5,7,7-heptachlorobicyclo-(2.2.1)-2-heptene

Hexachlorobenzene

1,2,3,4,7,7-hexachlorobicyclo-(2.2.1)-2,5-heptadiene

Hexachlorobutadiene

Hexachlorocyclopentadiene

Hexachloronobornadiene

Hexane

Hydrazine

Hydrochloric Acid + Sodium Salts

Hydrochloric Acid, Neutralized

Hydrofluoric Acid

Hydrogen Chloride Gas neutralized w/Caustic Soda

Hydrogen Cyanide

Hydrogen Peroxide

1,4-Hydroxybicyclo-(2.2.1) hept-2.5-diene

ypochlorite

jepal CA-897

npregnite,CC-2

npregnite,CC-3

ron

ron Compounds

sobutylmethacrylate Polymer

sodrin 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-endo, endo-demethanonaphthalene

sophorone

sopropyl Alcohol

s' ropyl Methyl Phosphonate

.lied Gasoline Residues

:elzan

:etones

Keto-endrin

LANDRIN* Insecticide Mixture of the 3,4,5 and the 2,3,5 trimethylphenyl methylcarbamate isomers, which are present in approximately a 4:1 ratio respectively

Lanthanum

Lauric Acid

Lead

Lead Azide

Lead Compounds

I--visite Arsenic

.visite Oxide

Lime, Chlorinated

ne, Type C

ndane

thium

A C_3H_7ON

gnesium

gnesium Compounds

gnesium Metal (Coarse, Dust, Powder)

gnesium Salts

lathion

nganese

nganese Compounds

perse B-22

CAA $C_8H_6OCl_3N$

CAA $C_3H_6OCl\ N$

DCAA $C_3H_5OCl_2N$

Mercuric Chloride

Mercury

Mercury Compounds

Methoxychlor

N-Methylacetoacetamide

Methylacetoacetate

Methylamine

Methyl Alcohol

2 ethylbenzyl acetoacetate

ethylbenzyl alcohol

a-methylbenzyl chloroacetoacetate

thyl Chloride

methyl-2-chloroacetoacetamide

thyl-2-chloroacetoacetate

methyl-2,2-dichloroacetoacetamide

thylene Blue Active Substances

thylene Chloride

thylene Isobutyl Ketone

thyl Isobutyl Ketone

thyl Isocyanate

thyl Mercaptan

ethyl Parathion 0,0-dimethyl-0-nitrophenyl thiophosphate

yl Parathion Related Salts

ethyl Phosphonic Acid

ethylphosphonicdichloride

ethylphosphonicdifluoride

Methylthioacetaldoxime

Methoxychlor

Mineral Spirits

Molybdenum

Mustard (H, HS, HD)

Naphthalene

Nickel

Niobium

rate

Nitrate Acid/Sulfuric Acid (Mixed)

itric Acid

itrite

-nitro sodium phenolate

UDRIN* Insecticide S-methyl-N-[(methylcarbamoyl)oxy] thioacetimidate

)rganic Phophorus

)rganophosphorus

)xathiane

?araffin

Paraffin, chlorinated

Parathion

Petroleum Oil Extract #2

2,2,2',4',5'-pentachlorophenone

.ol

Phenolics

m-Phenoxybenzaldehyde

PHOSDRIN* Insecticide Dimethyl phosphate of methyl 3-hydrozy-cis-crotonate

Phosphate

Phosphorus

Phosphorus, White and Red

Phosphorus Trichloride

PLANAVIN* Herbicide 4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline

Planavin Related Salts

Pluronic L-61

- tassium

.DRIN* Insecticide Cyno(3-phenoxyphenyl)methyl 4-chloro-alpha-(1-methyl ethyl)benzeneacetate

Rosin, wood

andium

9636**

13957**

1300**

15042**

lenium

ell Anti-freeze (59-14-6)

ell cyclo-sol 53

ell sodium sulfonates

ELLFLEX 210 Oil

lica

on

ilver

A 1440H

odium

Sodium Acetate

Sodium Bicarbonate

odium Bromide

odium Carbonate

odium Chloride

odium Fluoride

odium Hydroxide

odium Hypochlorite

** See RIC 8304R01, pp.12-14, microfilm RAA045, frames 1802-1084 for structure

odium Isopropoxymethyl Phosphine Oxide

odium Mercaptobenzothiazole

odium Metasilicate

odium Methylate

odium Methyl Phosphonate also MI acid

odium Nitrate

odium Nitrite

odium Orthophosphate

odium Salts

odium Sulfate

odium Sulfite

o 232

ponto 234

trontium

ulfate

Sulfone CH_4O_2S

Sulfur

Sulfur Dioxide

Sulfur Monochloride

Sulfur Tetrachloride

Sulfuric Acid

Sulfuryl Chloride

SUPONA* Insecticide 2-chloro-1(2,4-dichlorophenyl)vinyl diethyl phosphate

$C_2H_6O_2PSCl$

TDE

trachloroacetophenone

trachlorobenzene

trachloroethylene

tramethyl Urea

ickener M-1 (Napalm)

iodiglycol

ionyl Chloride

tanium

luene

xaphene

ibutylamine

5'-trichloracetophenone

,2,4-trichlorobenzene

richloroethylene

riethylamine

riethyl phosphite

,3,5-Trimethyl phenol

,4,5-Trimethyl phenol

rimethyl phosphite

riton X-100

ritium

ungsten

Vranine C

ium

ea

Vanadium

PONA* Insecticide	2,2 dichlorovinyl dimethyl phosphate
nyl Chloride	
ter	
eat Rust	
lene	
trium	
nc	
nc Compounds	
ircon	

Dimethyl disulfide
1,1,1-Trichlorothane
1,1,2-Trichlorothane
Phenyl methyl carbinol
Oxitol
Para-Chlorothiophenol
Mixed acid
Epichlorohydrin
Acetaldehyde
Coal
Armeen DMCD
D-D* Soil Fumigant
Hexylene glycol
ALDRITE* Insecticide
NEMAGON* Soil Fumigant
RAVAP* Insecticide
Shell Poultry Larvicide, Spray
DDVP
MONOCROTOPHOS 53
Dinitrochlorothiophenol
Heptane

APPENDIX D

US Army Accident/Injury Report
(DA 285 and DA 1051)

INSTRUCTIONS FOR DA FORM 285

GENERAL. The unit having the accident must investigate it and complete this report. Complete only shaded items for nonfatal off-duty accidents not involving Army operations or materiel. For all other accidents, complete all items except those for safety staff or Safety Center use only. Type or print the report. Items may be continued on an attached sheet. Items not in the instructions are self-explaining.

1a. Enter the six-part unit identification code (UIC) of the unit having the accident.

1b. Enter the description of the unit. For example, enter HHC 2/34 Inf, 194 CAV, Yuma PG.

2. If unknown, estimate.

3. Dawn is between first light and official sunrise. Dusk is between official sunset and night.

4. "On Post" means the accident happened on property under Department of Defense control.

5. Enter facts needed to locate the accident scene. As needed, enter building number or direction and distance from closest landmark; enter street or highway name or number; enter city or military installation; enter state and country.

SECTION A – PERSONNEL INVOLVED

Complete this section for each person involved in the accident. "Involved" means a person who was injured or who caused or contributed to the accident. If more than one person was involved, use more forms and complete only this section on them. Witnesses and uninjured passengers are not considered involved. Be sure to also complete this section on each supervisor who caused or contributed to the accident. Give the supervisory error in item 30. In case of damage to property with no personnel involved *(e.g., fire, natural disaster)*, report only items 6, 7 and 8 for the property custodian or the hand receipt holder.

7. Give official address for all Government personnel. Leave out for all others. Include the unit UIC if different from the UIC in item 1.

8. Complete for all Government personnel. Leave out for all others.

9. Enter pay grade for all Government personnel including foreign national employees. For example, enter E6, 04, WG8, GS 12, C-5A. Leave out for all others.

10-13. Complete for Government personnel only. Leave out for all others.

14. "On Duty" means *(a)* person was at duty station during duty hours; or *(b)* person was away from duty station during duty hours but on official business. Leave out for non-Government personnel.

15-16. Complete for Government personnel only. Leave out for all others.

18. Enter this person's activity or task. For example, enter firing rifle, lifting box, walking across street, driving truck.

19-21. Leave out if activity *(item 18)* was not required for training. For example, exclude horseplay, chow run, stand down.

22. Pick the term below that best describes the overall mission of the activity or task in item 18.

- Administrative; office
- Maintenance; repair, services
- Transportation; supply, disposal
- Production; construction
- Research; development, testing
- Emergency services; law enforcement
- Medical
- Physical training, recreation
- Food Services
- Other operation
- Personal; domestic
- Off duty

23. The following definitions apply:

b. Permanent total disability means person can never again do gainful work.

c. Permanent partial disability means person loses or can never again use a body part.

d. Lost workday case - days away from work means person misses one or more days of work.

e. Lost workday case - restricted work activity means person is temporarily unable to perform regular duties.

f. Nonfatal case without lost workday means person *(1)* was permanently transferred or terminated, *(2)* received treatment greater than first aid, *(3)* lost consciousness, or *(4)* had an occupational illness that did not result in fatality or lost workday.

g. First aid only means one time treatment of minor injuries.

24. Estimate the number of workdays this person will lose. Do not update this estimate unless this person dies.

25. Estimate the number of workdays this person cannot perform all regular duties after going back to work.

26. Describe this person's injury or occupational illness. For example, enter third-degree chemical burn, first-degree thermal burn, compound fracture, dermatitis, heatstroke, concussion.

27. For the injury or illness shown in item 26, give the body part involved. For example, enter left knee, lungs, right thumb, nose.

28. Pick from the list below the event that resulted in the injury or illness. Then give the thing that produced it. For example, enter struck against *door*; bodily reaction due to *slip*; overexertion due to lifting *box*; exposure to *noise*.

- Struck against . . .
- Struck by . . .
- Fell from elevation onto . . .
- Fell from same level onto . . .
- Caught in/under/between . . .
- Bodily reaction due to . . .
- Overexertion . . .
- Exposure to . . .
- External contact with . . .
- Ingested . . .
- Inhaled . . .

30. For each mistake this person made, pick one error from the list below. Use error in a sentence that includes the result of the error. For example, due to *improper attention*, SGT Jones did not yield the right of way to the other vehicle; PFC Smith made an *improper decision* to drive while under the influence of alcohol; Mr. English *failed to follow procedures (SOP)* and began spot welding without his safety goggles in place; due to *inadequate planning* by the company commander *(CPT Wright)*, there was no unit ice and snow removal program. As a result, PFC Carr broke his arm by falling on the icy steps.

- Inadequate inspection
- Improper attention
- Failed to recognize
- Misjudged clearance/ speed/weight/size
- Misinterpreted
- Failed to anticipate
- Inadequate planning
- Improper decision
- Inadequate improvising/ troubleshooting/ problem solving
- Failed to follow procedures/ orders/laws
- Failed to comply with general rules/principles
- Improper simple physical action *(lift, hold, drop, hit, push, pull, sit, stand, reach for, open, close, connect, disconnect, etc.)*
- Improper complex physical action *(walk, run, crawl, climb, carry, jump, align, adjust, steer, brake, etc.)*
- Inadequate communication *(ask, answer, signal, inform, etc.)*

SECTION B – PROPERTY AND/OR MATERIEL INVOLVED

31a. List all property involved in the accident whether damaged or not. For example, enter Tank, M60A1. "Property involved" means materiel which is damaged or whose use or misuse contributed to the accident.

31b. Give ownership for each item listed. For example, enter Army, Air Force, Army National Guard, contractor, or private.

31c. If accident involved Army operations, enter estimated total cost of damage. Total will include costs of parts and labor.

32. For each materiel failure or malfunction, pick one type from the list below. Use the type in a sentence to tell how the materiel failed. Include nomenclature of materiel as in item 31. For example, M60A1 fuel line connector *vibrated* loose and sprayed fuel over engine causing fire. F1500M road grader fuel brake master cylinder rubber piston seal *decayed* and failed, causing loss of fluid and brake failure.

- Overheated/burned/melted
- Froze *(temperature)*
- Obstructed/pinched/clogged
- Vibrated
- Rubbed/worn/frayed
- Corroded/rusted/pitted
- Overpressured/burst
- Pulled/stretched
- Twisted/torqued
- Compressed/hit/punctured
- Bent/warped
- Sheared/cut
- Decayed/decomposed
- Electric current action *(short, arc, surge, etc.)*

33. TM 38-750 requires a Category I EIR for materiel failures or malfunctions that cause or contribute to accidents.

SECTION C – ENVIRONMENTAL CONDITIONS INVOLVED

34. For each environmental condition, pick one type from the list below. Use the type in a sentence that describes its role in the accident. For example, driver's vision was restricted by fog; air breathed was *contaminated* by toxic fumes; heat exhaustion resulted from high *temperature*; person slipped and fell on *floor* made *slippery* by wax.

- Illumination *(dark, glare, etc.)*
- Precipitation *(rain, fog, ice, snow, etc.)*
- Contaminants *(fumes, dust, chemicals, FOD, etc.)*
- Noise
- Temperature/humidity
- Wind/turbulence
- Vibration
- Acceleration/deceleration
- Radiation *(sunlight, x-ray, LASER, etc.)*
- Work surface *(slippery floor, cluttered walkway, steep rough road, etc.)*
- Air pressure *(explosion, decompression, altitude effects, etc.)*
- Electricity *(lightning, arc, surge, short, shock, etc.)*

SECTION D – DESCRIPTION AND CORRECTIVE ACTION

35. Give the sequence of events that describes what happened leading up to and including the accident. In describing the factors be sure to *(a)* name personnel making errors, *(b)* tell how involved personnel are related to materiel listed in item 31, e.g., passenger in M151A2 or lighting immersion heater, and *(c)* tell how environmental conditions affected personnel or materiel. Continue on an attached sheet if necessary.

37. This item is to be completed by the commander or his representative.

38. Command review as locally required.

SAFETY STAFF USE ONLY

GENERAL. The safety staff will complete this section on all accidents. The safety staff will investigate all accidents requiring a DA Form 285-1 and will attach it to this report.

39. When change is checked, items 1, 2, 6 and 8 must be completed plus any changes.

40. Enter MACOM of the unit shown in item 1. For example, enter FORSCOM, TRADOC, USAREUR, NGB, or COE.

42. From the list below, select the type that best describes this accident. Types are listed in order of precedence to help pick one when more than one applies.

- Army motor vehicle
- Army combat vehicle
- Army operated vehicle
- Privately owned vehicle
- Marine diving
- Marine underway
- Marine not underway
- Other Army vehicle
- Fire
- Chemical
- Explosive
- Missile
- Radiation
- Nuclear
- Personnel injury – other
- Property damage – other

43. Describe the type of vehicle collision. For example, ran off road

UNITED STATES ARMY ACCIDENT INVESTIGATION REPORT

For use of this form, see AR 385-40; the proponent agency is DCSPER.

REQUIREMENT CONTROL SYMBOL CSGPA – 1471R41

NOTE: SPACES, BELOW, DEFINED BY HEAVY LINES ARE FOR "SAFETY CENTER USE ONLY."

1. UNIT IDENTIFICATION — a. UIC; b. DESCRIPTION

2. TIME AND DATE OF ACCIDENT — a. YEAR; b. MONTH; c. DAY; d. HOUR

3. TIME OF DAY (Check one) — ☐ a. DAWN ☐ b. DAY ☐ c. DUSK ☐ d. NIGHT

4. LOCATION — ☐ a. ON POST ☐ b. OFF POST

5. EXACT LOCATION OF ACCIDENT

SECTION A – PERSONNEL INVOLVED

6. NAME (Last - First - MI)

7. ADDRESS (Use official address for all Government personnel)

8. SOCIAL SECURITY NUMBER

9. GRADE

10. AGE

11. SEX — ☐ a. MALE ☐ b. FEMALE

12. MOS OR CIVILIAN JOB SERIES

13. FLIGHT STATUS — ☐ a. YES ☐ b. NO

14. DUTY STATUS — ☐ a. ON DUTY ☐ b. OFF DUTY

15. NO. OF HOURS ON CONTINUOUS DUTY BEFORE ACCIDENT

16. NO. OF HOURS SLEEP IN LAST 24 HOURS (If hours on duty more than 8)

17. CLASSIFICATION AT TIME OF ACCIDENT (Check appropriate box)

☐ a. ACTIVE ARMY ☐ b. ARMY CIVILIAN ☐ c. ARMY CONTRACTOR ☐ d. NONAPPROPRIATED FUND ☐ e. OTHER U.S. MILITARY ☐ f. ROTC ☐ g. DEPENDENT

NATIONAL GUARD: ☐ h. TECH ☐ i. IDT ☐ j. AT ☐ k. FTTD ☐ l. FTM ☐ m. ADT

ARMY RESERVE: ☐ n. IDT ☐ o. AT ☐ p. ADT ☐ q. FTM

FOREIGN NATIONAL: ☐ r. DIRECT HIRE ☐ s. CONTRACT HIRE ☐ t. KATUSA

☐ u. OTHER (Specify)

18. THIS PERSON'S ACTIVITY/TASK AT TIME OF ACCIDENT

19. IF THIS PERSON'S ACTIVITY WAS NECESSARY PART OF TRAINING, GIVE TYPE — ☐ a. BASIC (School) ☐ b. ADVANCED (School) ☐ c. OJT (Unit) ☐ d. PROFICIENCY (Unit) ☐ e. OTHER (Specify)

20. WAS THIS PERSON'S ACTIVITY PART OF FIELD EXERCISE? — ☐ a. YES ☐ b. NO

21. WAS THIS PERSON'S ACTIVITY PART OF TACTICAL TRAINING? — ☐ a. YES ☐ b. NO

22. OPERATIONAL CATEGORY (Identify operational category that best describes the overall mission at time of accident.)

23. SEVERITY OF INJURY TO THIS PERSON (Check only one)

☐ a. FATAL ☐ b. PERMANENT TOTAL DISABILITY ☐ c. PERMANENT PARTIAL DISABILITY ☐ d. LOST WORKDAY CASE - DAYS AWAY FROM WORK ☐ e. LOST WORKDAY CASE - RESTRICTED WORK ACTIVITY ☐ f. NONFATAL CASE WITHOUT LOST WORKDAYS ☐ g. FIRST AID ONLY ☐ h. NO INJURY ☐ i. MISSING AND PRESUMED DEAD

24. WORKDAYS LOST (estimate)

25. WORKDAYS RESTRICTED (estimate)

26. TYPE/NATURE OF INJURY/OCCUPATIONAL ILLNESS

27. BODY PART AFFECTED

28. CAUSE OF INJURY/OCCUPATIONAL ILLNESS

29. VEHICLE RESTRAINT SYSTEM — ☐ a. USED ☐ b. NOT AVAILABLE ☐ c. NOT APPLICABLE ☐ d. AVAILABLE BUT NOT USED

30. THIS PERSON'S ERRORS WHICH CAUSED OR CONTRIBUTED TO THE ACCIDENT (Describe each mistake and the result)

SECTION B – PROPERTY AND/OR MATERIEL INVOLVED

31. LIST ALL PROPERTY INVOLVED IN THE ACCIDENT, WHETHER DAMAGED OR NOT. IF ACCIDENT INVOLVED ARMY OPERATIONS, SHOW COST OF ANY DAMAGE.

NO.	a. NAME OF ITEM (Complete nomenclature, i.e., make, type, model)		b. OWNERSHIP		c. AMOUNT OF DAMAGE
1					
2					
3					

32. MATERIEL FAILURE(S)/MALFUNCTION(S) WHICH CAUSED OR CONTRIBUTED TO THE ACCIDENT (Tell what failed and how it failed)

33. CONTROL NUMBER FOR THE EIR COVERING EACH FAILURE/MALFUNCTION (Block 3 of SF 368)

SECTION C – ENVIRONMENTAL CONDITIONS INVOLVED

34. ENVIRONMENTAL CONDITION(S) WHICH CAUSED OR CONTRIBUTED TO THE ACCIDENT

SECTION D – DESCRIPTION AND CORRECTIVE ACTION

35. FULLY DESCRIBE THE ACCIDENT (When materiel is listed in item 31, tell how involved personnel are related to it.)

36. ACTION TAKEN, ANTICIPATED, OR RECOMMENDED TO CORRECT THE CAUSE(S) OF THIS ACCIDENT

37. SIGNATURE OF COMMAND REPRESENTATIVE

38. COMMAND REVIEW — a. ; b. ; c.

SAFETY STAFF USE ONLY

39. REPORT SUBMISSION — ☐ a. INITIAL ☐ b. CHANGE

40. MACOM

41. LOCAL REPORT NUMBER

42. ACCIDENT TYPE

43. TYPE OF VEHICLE COLLISION

44. SAFETY STAFF POINT OF CONTACT (Include printed name and phone)

45. SPECIAL REQUIREMENTS

46. DATE REPORT COMPLETED (Yr - Mo - Day)

☆ U.S. GOVERNMENT PRINTING OFFICE 1975-567-949

RECORD OF INJURY

For use of this form, see AR 385-40; the proponent agency is the Office of the Deputy Chief of Staff for Personnel.

SECTION I - *To be completed by Supervisor and delivered by patient, if possible, to dispensary or first aid station*

1. LAST NAME - FIRST NAME - MIDDLE INITIAL *(Person injured)*	2. GRADE	3. SERVICE/SOCIAL SECURITY ACCT NO	4. AGE

5. OCCUPATION OR DUTY WHEN INJURED	6. INJURY		7. RETURN TO DUTY		8. EXACT LOCATION WHERE INJURY OCCURRED
	HOUR	DATE	HOUR	DATE	

9. HOW INJURY OCCURRED *(exactly what injured was doing and what caused the injury)*

10. UNIT OR ORGANIZATION	11. NAME OF SUPERVISOR, MILITARY OR CIVILIAN *(print or type)*	12. TELEPHONE

SECTION II - *To be completed by Medical Officer or attendant for information of the Supervisor and others, as appropriate*

1. NATURE AND EXTENT OF INJURY OR OCCUPATIONAL ILLNESS

2. DISPOSITION *(Check one)* ☐ RETURN TO REGULAR DUTY ☐ RETURN TO WORK OF LIGHT NATURE ☐ HOSPITAL ☐ SEND HOME OR TO QUARTERS ☐ OTHER *(Specify)*

3. ESTIMATED ABSENCE IN DAYS BEYOND DAY ON WHICH INJURY OCCURRED	4. NAME OF MEDICAL OFFICER OR ATTENDANT *(Print or type)*	5. TELEPHONE

NOTE: Sections III and IV should not be completed before Section II.

SECTION III - SUPERVISOR'S ACCIDENT ANALYSIS

(This list of general causes is provided to help the supervisor identify specific accident causes which can be corrected.)

ENVIRONMENTAL

1. UNSAFE METHODS, PROCESSES, PROCEDURES.
2. INADEQUATE SAFEGUARDS, SAFETY EQUIPMENT.
3. IMPROPER OR DEFECTIVE EQUIPMENT.
4. HAZARDOUS LOCATION
5. POOR HOUSEKEEPING

PERSONAL FACTORS

6. PHYSICAL CONDITION - VISION, AGE, WEIGHT, FATIGUE.
7. EMOTIONAL - ANGER, FEAR, RESENTMENT, WORRY
8. LACK OF SKILL OR KNOWLEDGE.
9. ATTITUDE - INDIFFERENT, BELLIGERENT.
10. UNSAFE WEARING APPAREL OR MANNER OF DRESS

USING THE ABOVE GUIDANCE, STATE SPECIFIC CAUSES

SECTION IV - SUPERVISOR'S RECORD OF CORRECTIVE ACTION TAKEN *(Types of corrective action that may be appropriate are: Supervision, Education, Training, Administrative Action, Engineering, Design, Repair, Maintenance.)*

USING THE ABOVE GUIDANCE, STATE SPECIFIC ACTIONS TAKEN TO PREVENT RECURRENCE

APPENDIX E

ODOR PROPERTIES OF SOME RMA CHEMICAL AGENTS

APPENDIX E

Odor Properties of Some RMA Chemical Agents

Odor	Common Name
Newly Mowed Hay	Phosgene, Diphosgene
Fruity	Tabum, Soman, Nitrogen Mustard
Peach Kernel	Hydrogen Cyanide
Garlic	Arsine, Distilled Mustard, Mustard-Timex
Geranium	Lewisite

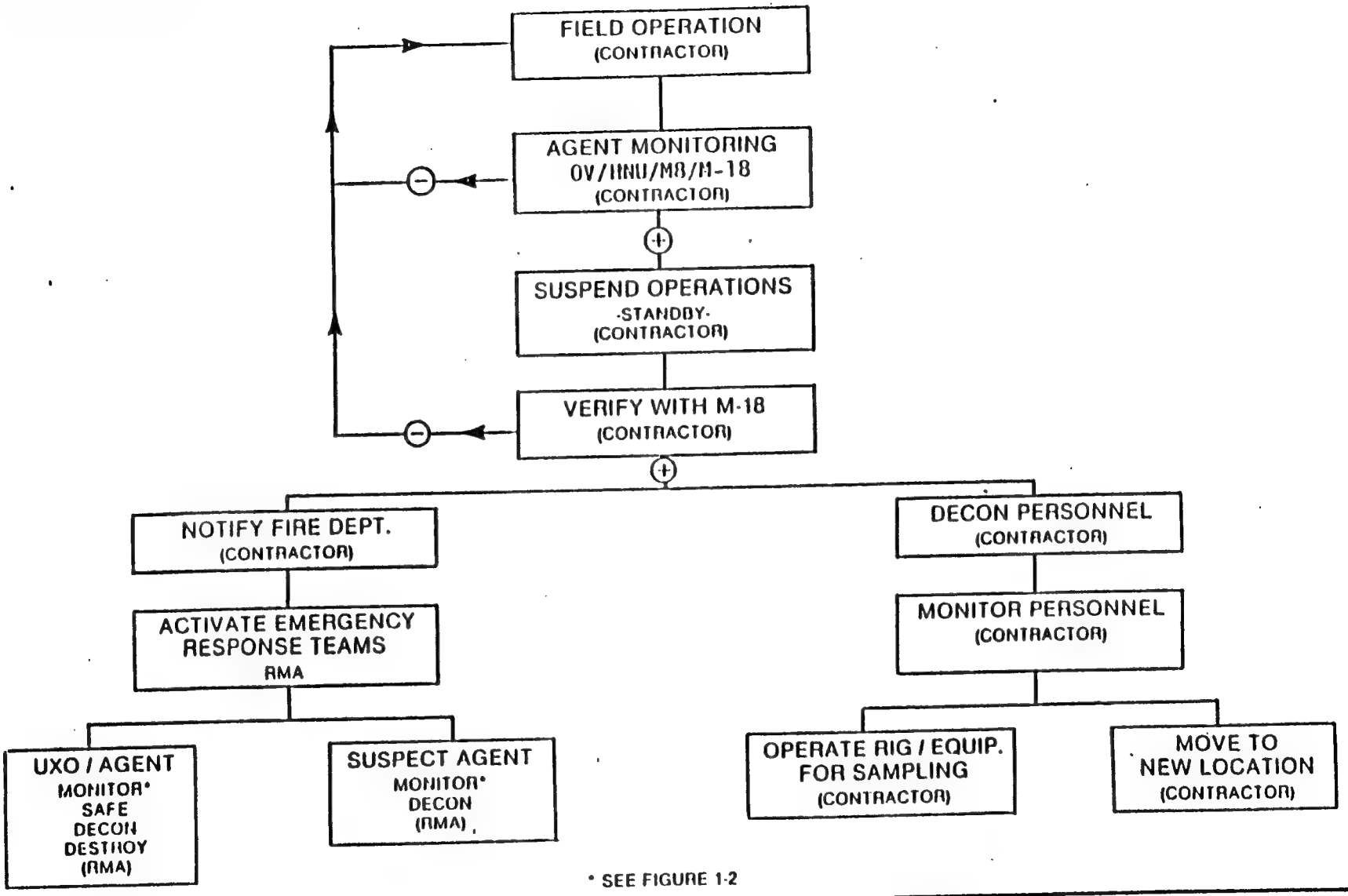
APPENDIX F

CHEMICAL AGENT RESPONSE GUIDELINES

1.0 INTRODUCTION

Field investigation activities at Rocky Mountain Arsenal (RMA) will be conducted in areas where historical records indicate disposal of chemical agents may have occurred. The compounds, developed by the military for defending against the enemy during warfare, include nerve, blistering, and choking agents. Onsite contractor personnel performing varied drilling, development, and sampling activities have a limited potential for exposure to low levels of agents through contact with contaminated soils, liquids, or inhalation of vapors. In addition, there is an extremely low probability that well drilling and soil sampling activities may reveal unexploded ordnance (UXO). Such devices could contain explosives and/or chemical agents. It is of uppermost concern that when these materials are suspected and/or detected proper response procedures are quickly and efficiently carried out by all personnel involved. The following sections discuss chemical agents and the response procedures of field teams and RMA personnel when agents are suspected and/or detected. Figure 1-1 summarizes emergency response actions as detailed in this report.

FIELD ACTIONS TAKEN FOR DETECTION OF CHEMICAL AGENTS



* SEE FIGURE 1-2

Figure 1-1
EMERGENCY RESPONSE ACTION

Prepared for:
U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground, Maryland

2.0 AGENTS

There are three general classes of agent known to have been stored at RMA. These are nerve agents, including GB and VX; choking agents such as phosgene; and blistering agents such as the mustard gases and Lewisite.

Agent GB is an organophosphorus compound similar to, but more toxic than, some of the insecticides in wide use today. It inhibits one of the important enzymes in the body, acetylcholinesterase (ChE). ChE is necessary for the destruction of acetylcholine. Acetylcholine, the key compound connected with transmission of nerve impulses, is usually broken down by ChE in a fraction of a second after transmission of the nerve impulse. If acetylcholine is not inactivated, as in the case of poisoning with agent GB, continued stimulation and increased function and finally exhaustion and paralysis occur.

The agent can be absorbed through the skin and easily inhaled through the respiratory tract. Oral ingestion can occur although it is a less common mode of entry. Symptoms may include a runny nose, pinpointing (myosis) of pupils, dimness of vision (especially at night), tightness of the chest, difficulty in breathing, excessive sweating, drooling, nausea and vomiting, convulsions, and death. Nerve agents are quick acting when inhaled with some symptoms developing within one or two minutes after inhalation. They act more slowly when absorbed through undamaged skin. When the eyes are exposed to nerve agent vapor or aerosol, the pupils will become pinpointed; however, pinpointing of the pupils may not occur for five to ten minutes or even longer after exposure to a very low vapor concentration of the agents. When the skin is contaminated with nerve agent, the pupils of the eyes may remain normal or become only slightly reduced in size. Excessive sweating may occur at the site of skin contamination. Just as symptoms may develop after a one-time exposure to significant amounts of the agents, repeated exposure to even very low

concentrations of the agent over a period of days or weeks tend to be cumulative in effect and may also result in development of symptoms. Removal of exposed personnel from GB agent activities is beneficial in reducing the symptoms.

VX is the standard V agent, a colorless, odorless liquid which does not evaporate rapidly or freeze at room temperature. This allows a long duration of effectiveness and low lethal dosages. Symptoms for VX exposure are the same described above for GB.

Choking agents cause injury primarily in the respiratory tract. Membranes swell and close off passages. Tissues rupture filling the lungs with fluid eventually drowning the victim.

Blistering agents are used to cause casualties and restrict ground movement. They affect the eyes, lungs, and blister the skin. They generally have a distinctive odor and a high duration of effectiveness. Some have been developed which are odorless and produce little or no pain on contact. Symptoms develop after a short delay (4 to 6 hours) and include redness of the skin, irritation, itching, stinging sensations, water blisters,and/or ulceration and inflammation of the nose, throat, and lung tissue. Protection is difficult as any part of the body exposed to the liquid or vapor is susceptible.

Mustard gases all have similar chemical properties and action and produce related symptoms. They differ in production methods, physical properties and blistering powers.

Distilled mustard (HD) is a light yellow, oily liquid purified by washing and vacuum distillation and therefore has less odor and good blistering power. Mustard exhibits a slight garlic like odor. Skin absorption can cause death or incapacitation. Wet skin will absorb more mustard than dry and therefore mustard has a lower lethal dosage in hot, humid weather. The eyes are very susceptible to low concentrations, but higher doses are necessary to produce incapacitation from skin absorption.

Mustard acts first as a cell irritant eventually destroying the cells of the tissue affected. First symptoms appear within 4 to 6 hours; the higher the concentration, the quicker the symptoms appear. Injuries produced by HD heal slowly and are very susceptible to infection. The blood vessels are damaged preventing repair functions and the good medium for bacterial growth provided by the dead tissue further spreads the infection.

Nitrogen mustard (HN) is a dark liquid similar to HD but is a derivative of ammonia and causes many of the same effects. It has a faint fishy or musty odor with equal eye and skin toxicity as HD. HN however, causes cell division resulting in tissue injury and severe diarrhea with lesions in the small intestine. Effects on the respiratory system include irritation of the nose, throat and bronchi resulting in labored respiration and bronchopneumonia after approximately 24 hours.

Lewisite (L) is a mustard related agent with a faint geranium like odor. It also is a blistering-agent with a delayed action similar to distilled mustard. It is a less lethal blistering agent because of its high vapor pressure and short duration of effectiveness. It produces effects similar to HD but also acts as a systemic poison causing pulmonary edema, diarrhea, low body temperature and low blood pressure. Liquid L causes searing sensation of the eye and permanent blindness if not decontaminated in one minute. Blistering may not appear for approximately 13 hours after exposure and is much deeper than HD. It can be fatal within 10 minutes if high doses are inhaled.

3.0 FIELD OPERATIONS

Day-to-day field operation in potentially contaminated sources on RMA will follow all safety procedures discussed in the Safety Plan for each area. In these areas where potential occurrence of chemical agents may exist, additional safety requirements have been identified. Standard operating procedures for such areas will include the following program.

A minimum of Level C protection will be utilized at all times within the exclusion zone determined for each operation, minimally defined as an areas within 30 ft of an open borehole, excavation, well, or sample. Exposure time for an individual within this zone will be minimized to the extent possible. That is, support operations and driller standby should be conducted outside of the 30 ft exclusion zone when not essential for boring, and sample handling.

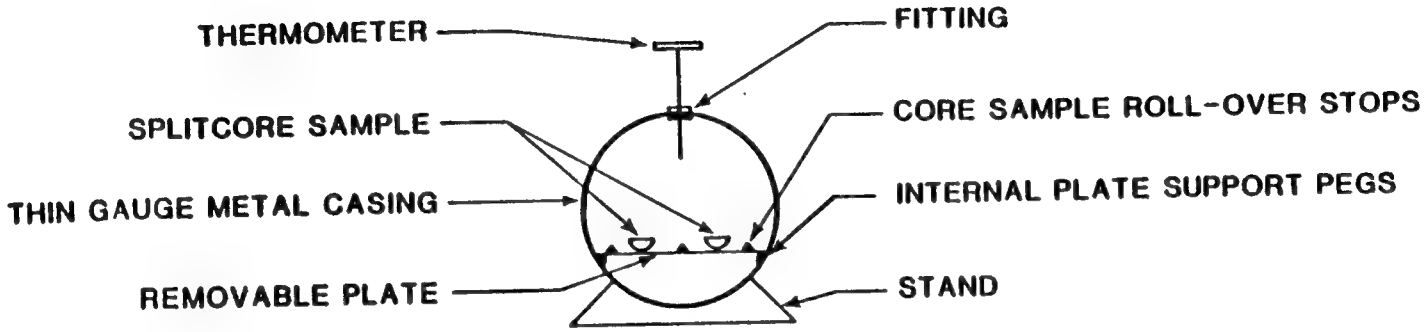
Monitoring with the HNU, OVA, M-8, M-18 and other devices will be conducted by the OSO continuously. All samples to be removed from the exclusion zone will be monitored or analyzed as follows:

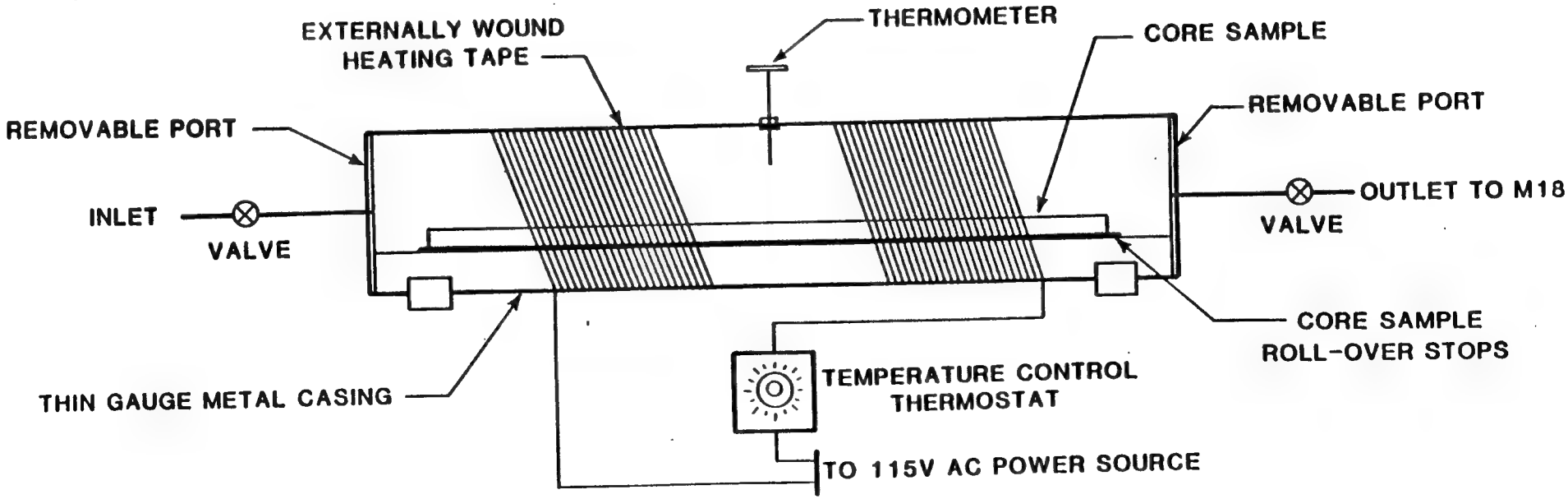
- Core sample for chemical analysis--One-foot core is being collected from predetermined depths from each boring. These cores are sent offsite to laboratories for chemical analyses. It is therefore necessary to determine the presence of chemical agents before removal from RMA. A subsample of each core will be removed and placed in a pre-weighed amount of solvent and taken to the RMA laboratory for immediate analyses of mustard and GB in soil by certified USATHAMA methods. These semi-quantitative methods have detection limits of 2.0 micrograms per gram (µg/g) of soil for mustard and 72 nanograms per gram (ng/g) for GB. The detection of either compound will prohibit the removal of the contaminated core sample from RMA. This sample will be handled by RMA personnel as discussed in Section 7.0.
- Core sample for geologic logging--A core sample, usually 4 ft in length, is collected form each interval for geologic logging by trained personnel. Logging may occur immediately onsite or

the core may be removed to a central area for logging. Before logging occurs, this core will be monitored for the presence of chemical agents. The cores will be split open and placed within a specially designed heating chamber (Figure 3-1). Internal temperature of the chamber will be maintained at approximately 40°C for not less than 15 minutes. The raised temperature will volatilize any significant amount of mustard and/or GB within the minimal volume of the chamber above the level of detection of the M-18A monitoring device. Thus, following the heating period, the M-18 will be used to sample the off-gas for chemical agents. If the results are negative, the cores will be logged and stored. If a positive result is obtained, the bore will be considered contaminated with chemical agents and procedures initiated as discussed in the following sections of this document.

Figure 3-1

SOIL SAMPLE HEATING DEVICE





4.0 CONTRACTOR ONSITE PERSONNEL RESPONSE TO SUSPECTED/DETECTED AGENTS

The contractor's Onsite Safety Officer (OSO) will utilize various detection devices to continuously monitor conditions during field operations to determine the presence of agents in air or water. Devices include: the M-8 alarm for airborne phosgene and nerve agents; the M-18A2 detection kit for airborne agents including mustards, Lewisite, phosgene, and nerve agents; and the HNU PI-101 and the Photo-Vac TIP photoionization instruments for airborne mustards and nerve agents.

In the event an agent is suspected and/or detected onsite during investigation activities, the OSO will immediately curtail operations. In areas where historical documentation reveals the potential for chemical agents to be present, personnel will enter the site in Level C protection at a minimum. All onsite personnel will promptly withdraw by an upwind route, to the contamination reduction corridor (CRC) and standby for further instructions. The OSO will radio the command post informing that agent is suspected. The OSO and a member of the field team will dress out in appropriate level protection and return to the site to verify initial readings using the M-18A detection kit. If a negative situation is realized, the OSO may at this time permit resumption of field operations. In cases of confirmed agent detection, the OSO will immediately contact the command post and verify the presence of compounds. Onsite personnel will proceed through decontamination procedures as outlined in the safety plan. Individuals will be examined by emergency medical personnel and monitored for symptoms. All potentially contaminated clothing will be removed and stored in sealed plastic bags until decontamination verification monitoring is performed.

During drilling activities, it is possible that UXO may be encountered despite pre-drilling detection surveys. The UXO may be in the form of shells or bomblets containing chemical agents. In the event UXO is encountered, field activities will cease immediately. Personnel will immediately evacuate to the CRC, and standby for further instructions. The OSO will notify the command post of a UXO situation. Following

command post notification the command post will immediately notify the RMA Fire Department for coordination of RMA personnel or Technical Escort Unit (TEU) response to determine if any agent is present. If none are detected, a new location will be chosen for drilling and work will proceed. If agents are detected, response procedures outlined previously will be followed.

If a known exposure has occurred, the OSO will immediately notify the command post of the situation and evacuate the area. Onsite personnel will proceed to the CRC where first aid (Table 4-1) and decontamination will be performed as quickly as possible. All potentially contaminated clothing will be removed and stored in sealed plastic bags until decontamination verification monitoring is performed.

Table 4-1. First Aid

1. GB and VX

   Skin contact: Wash area with hot, soapy water. Administer atropine if symptoms appear. Get prompt medical attention.
   Inhalation: Administer atropine if symptoms appear. Obtain immediate medical attention.
   Eye Contact: Administer atropine if symptoms appear. Obtain immediate medical attention.

2. Phosgene

   Person should be moved to area of fresh air and obtain prompt medical attention.

3. Mustards and Lewisite

   Skin contact: Gently blot off liquid with gauze or sponge, wash with 5 percent hypochlorite bleach, then wash area promptly with hot soapy water and obtain prompt medical attention.
   Inhalation: Obtain immediate medical attention.

5.0 CONTRACTOR DECON PERSONNEL RESPONSE TO SUSPECTED/DETECTED AGENTS

Decon personnel will respond as if agent is present at all times when decontaminating equipment, sample containers, or personnel who have been onsite. Proper protective gear - respirators, Saranex suits, rubber boots, latex rubber boot covers, chemical resistant gloves, disposable inner gloves, and eye protection - will be worn at all times during decon procedures. All personnel and materials from the zone of contamination will be considered contaminated and treated accordingly.

If agents are detected onsite, decon personnel will be notified by the command post personnel of this fact. Decon personnel will don air purifying respirators and assist in decontamination of equipment and personnel. The onsite safety officer will continue to monitor during these activities. All personnel will avoid direct contact with protective clothing and equipment until it has been thoroughly decontaminated.

In no case will potential agent contaminated items be removed from RMA.

6.0 CONTRACTOR COMMAND POST PERSONNEL RESPONSE TO SUSPECTED/DETECTED AGENTS

Command Post personnel will be in constant radio contact with onsite personnel. Command Post personnel will be ready at all times to respond to situations when agents and/or UXO are suspected/detected. After receiving the message from the OSO that agents and/or UXO have been detected, command post personnel must act quickly and efficiently.

After gathering the information from the OSO the command post personnel will:

1) Notify the RMA Fire Department (RMAFD) personnel of the agent/UXO incident giving exact location of personnel and as much detail as possible. (e.g.: confirmed agent, known exposure, UXO situation only, etc.). See Table 6-1 for list of telephone numbers.
2) Notify decon personnel of situation so that they can react accordingly.
3) Assist in emergency procedures.
4) Standby for further communications.
5) Complete report of suspected chemical agent (Figure 6-1).

Table 6.1. Telephone Notification List

Organization	Person to Contact	RMA Extension	Commercial No.
RMA Fire Deptartment	Ray Pimple, Chief	223	(303) 289-0223
RMA Technical Escort Unit	Sgt. Baker	246	(303) 289-0246
RMA Safety Office	Alma T. Harris	338	(303) 289-0338
RMA Laboratory	Elijah G. Jones	194	(303) 289-0194
ESE OSO	Michael A. Thomas (Command Post)	--	(303) 287-3065
EBASCO OSO	Darrell Dechant (Command Post)	--	(303) 877-2848
USATHAMA Safety Officer	Dan Lillian	--	(301) 671-2525

Figure 6-1

Contractor Report of Suspected Chemical Agent

Date & Time_____

Site Safety Supervisor:_____

Location:_____

Describe Activities in Progress:_____

_____

_____

Personnel Present:_____

_____

Notification to Fire Department _____hrs. ____/____/____

Method of Detection

_____Physiological Symptoms (describe):_____

_____

_____Smell/Odor (describe):_____

_____

_____M18A2 Detector Kit: color of tube band_____

number of drops from which bottle_____

detector ticket_____

color response of tube or ticket_____

_____M8 Alarm

_____M8 Detector Paper (color)_____

_____HNU Photoionization Analyzer Model PI-101 (_____ppm)_____

_____Foxboro OVA Model 128 (_____ppm)_____

_____Other_____

_____

Table 6-1. Telephone Notification List

_____

7.0 RMA RESPONSE

The RMAFD Fire Department will be the point of contact (POC) for all contractor field personnel in the event of emergency, suspected/detected chemical agent incidents, or UXO situations. The Fire Chief or his representative will initiate the required course of action for these situations. He will be responsible for activation of the appropriate emergency response units and the notification of RMA and TEU personnel and other agencies as deemed necessary. At a minimum, the Fire Chief will notify the Commander, RMA, the Director of Technical Operations, and the RMA Safety Office.

In the event of personal injury, fire or life threatening situations, the fire department will take the immediate action necessary to control the situation. For detection of chemical agents the response will be tailored to each individual situation. As a minimum RMA and TEU personnel will respond to the site to conduct field reconnaissance and monitoring to verify the detection and location of contamination. If explosive ordnance or agents are involved, the TEU will follow the procedures in AR 75-15, "Responsibilities and Procedures for Explosive Ordnance Disposal".

If no agent is detected by TEU at the site, operations will be resumed after recommendation by TEU and concurrence of the OSO by signing the RMA Field Reconnaissance and Monitoring form (Figure 7-1).

When bubblers or solid sorbent tubes are deemed necessary for collection of contaminants in air for laboratory analysis, RMA Technical Escort personnel will consult RMA Laboratory personnel (Chief, Analtyical Systems Branch). Close coordination with RMA Laboratory personnel is needed to ensure proper assembly and operation of the sampling train. Contractor analytical laboratories are not equipped to perform analysis for military toxic chemical agents, therefore the RMA Laboratory will perform analysis of water, soils, and other solids for chemical agents GB and Mustard, when field monitoring instruments indicate their presence.

Figure 7-1

RMA Field Reconnaissance and Monitoring

for Suspected Chemical Agent

Date & Time of Investigation: _____

Date & Time of Detection by Contractor: _____

RMA Personnel Conducting Field Investigation: _____

_____

_____

Describe Activities, Protective Clothing, Instruments, and Equipment:

_____

_____

Describe Monitoring Performed at Site: _____

_____

_____

Describe Observations and Action Taken: _____

_____

_____

Conclusion:

_____ No Agent Found, Resume Operations

_____ Agent Found, Decontaminated, Resume Operations

_____ Agent Found, Area Isolated, No Further Operations

Signature of TEU-IOC _____

Signature of Contractor OSO _____

Areas and items to be monitored should be enclosed to the maximum extent practical to avoid dilution caused by wind, and to allow vapors to concentrate as they are given off during the monitoring period. The monitoring period will normally be a minimum of 30 minutes for each suspect area/item/source, unless positive identification is obtained sooner. Bubblers or solid sorbent tubes used for air monitoring will be labelled in the field with the following information: date and time, location, collection period, air flow rate, ambient air temperature, and a list of agents to be analyzed. Appropriate RMA Environmental Division SOPs will be followed in the collection, handling, analysis, and data generation of air samples (see Table 7-1 for list of SOPs).

If RMA Personnel decide that collection of samples at the site is warranted, based on monitoring data or other considerations, RMA Technical Escort personnel will perform sample collection. Samples will be collected in amber glass jars with Teflon-lined lids.

Soil and other solid samples will be labelled with the following information: date and time sample collected, date and time of alarm, boring number, sample number, and suspected chemical agents.

Water samples will be labelled with the following information: date and time sample collected, date and time of alarm, well location, ground water level, and suspected chemical agents.

All samples will be refrigerated, treated as agent-contaminated, and taken to B-313 for priority analysis. Chain of custody forms will be completed by RMA Technical Escort personnel and will accompany the samples.

Analysis of soil, other solids, and water samples with suspected or confirmed presence of chemical agents GB and/or Mustard will be performed by RMA Laboratory personnel who have been certified to perform the chemical analysis. Samples with suspected or confirmed presence of other chemical agents will be forwarded to the Chemical Research and Development Center for confirmatory chemical analysis where necessary.

Table 7-1. RMA Laboratory SOPS for Support of Contamination Surveys

SOP Number	Title
SMCRM-TOE-16	Total Mustard (H, HN-1, HN-3) Emissions
SMCRM-TOE-17	Low Level Sarin (GB)
SMCRM-TOE-18	Lab Sample and Data Flow
SMCRM-TOE-19	Laboratory Quality Control
SMCRM-TOE-29	Lab Waste Disposal
SMCRM-TOE-79	Analyst Certification
SMCRM-TOE-80	Total Mustard (H) and/or GB in Solids by Gas Chromatography
SMCRM-TOE-82	Total Mustard (H) and/or GB in Aqueous Liquids

Semi-quantitative analytical methods, as described in the USATHAMA QA program will be used. If agent is detected in the initial screening analysis, the sample may undergo further analysis using quantitative analytical methods. Appropriate RMA Laboratory SOPs will be followed in the handling, analysis, and data generation of soil, other solids, and water samples (see Table 7-1 for list of SOPs).

TEU personnel will isolate the area under investigation until the lab analyses are completed. Equipment on site may be monitored, decontaminated and removed from the site to conduct operations at another location within RMA. In no case will agent-contaminated items be removed from RMA. Whatever action is taken on site, the results must be documented on the form shown in Figure 7-1 and concurrence made by the site safety officer.

All samples found to contain agents will be treated chemically or thermally to reduce the agent concentration to an undetectable level prior to disposal. For those sites where chemical agents are found, RMA will make a case-by-case determination of what cleanup action will be taken. As a minimum, the area will be clearly labelled with yellow engineering tape, signs posted stating "Chemically Contaminated Area-Keep Out", and the proper designator sign on all four sides of the area, e.g., H, L, GB or VX.

8.0 FINAL REPORT

The compilation, preparation, and distribution of a final report detailing the suspected/detected chemical agent response incident will be the responsibility of the Chemical Accident Incident Control Officer (CAICO). The report's contents will vary depending upon the nature of the incident and whether or not agents are detected but, should include the following:

1. Contractor Report of Suspected Chemical Agent;
2. Form 1051 and/or Form 285 (Contractor Completed);
3. TEU Report;
4. Lab Results (if agent detected);
5. CAIC after Action Report (if required).

Copies of the final report should be forwarded to:

1. Commander, RMA;
2. Contractor OSO; and
3. Program Manager, USATHAMA.

APPENDIX G

PROCEDURES FOR CONFINED SPACE/LIMITED EGRESS ACTIVITIES

Procedure for Confined Space/Limited Egress (CS/LE) Activities

Entry into a confined space/limited egress (CS/LE) enclosure shall only be undertaken where there is no alternate means of obtaining the necessary results. Thus, CS/LE entries are to be recognized as a means of last resort.

For the purpose of this document, CS/LE enclosures are defined as any space or enclosure that: has limited openings for entry and egress; may have limited ventilation; may contain or produce life threatening atmospheres due to oxygen deficiency, or the presence of toxic, flammable and or corrosive contaminants; and which is not intended for continuous employee occupancy. Examples of CS/LE enclosures may include BUT ARE NOT LIMITED TO: storage tanks, ship compartments, process/reaction vessels, stacks, pits, basements, silos, vats, degreasers, boilers, ventilation and exhaust ducts, manholes, sewers, tunnels, underground utility vaults, pipelines and any open topped space four feet or more in depth that is not subject to adequate ventilation.

The configuration of the space and the proposed operation to be conducted within that space will ultimately determine if a CS/LE condition exists.

I. Entry Permit System

Entry into a CS/LE enclosure shall be by permit only. The permit serves as written approval and authorization for an entry of a specific space for a specific task. The permit certifies that existing and potential hazards have been evaluated by the on-site health and safety officer and identifies the protective measures specified to ensure worker safety. The entry permit when completed will serve as a final safety briefing outline before entry and will be reviewed with the entry team and standby personnel. The entry permit will identify:

A) The location of the CS/LE and a description of the entry task.

B) Known and potential hazards that may be encountered in the CS/LE.

C) Isolation Checklist

1) blanking and or disconnecting of all lines
2) electrical lockout and tagout (both)
3) mechanical isolation and tagout (both)
4) mechanical ventilation (volumes)

D) Protective Equipment and Clothing Required

1) level of protection
2) safety harness and/or lifelines
3) extraction devices
4) tools and electrical equipment approvals (including lighting and communications devices)

E) Pre-entry Atmospheric Monitoring

1) oxygen level
2) combustible gas/vapor level
3) toxic substances level

F) Provisions For Continuous Atmospheric Monitoring

1) equipment
2) evacuation criteria

G) Identification of Entry Team

1) personnel to make entry
2) personnel on standby

H) Emergency Procedures and First Aid Equipment Location

I) Training Required

1) CS/LE entry
2) CS/LE rescue
3) in respirator use

II. Medical

A) Persons assigned to operations that will include CS/LE shall participate in the medical surveillance program established by Ebasco including the annual re-examination.

B) One or more persons involved as standby or other outside activities shall be currently trained in cardiopulmonary resuscitation (CPR) and Basic First Aid procedures. The employees shall be aware of how to obtain emergency assistance

and medical attention. They shall also have immediate access to adequate supplies of first aid equipment.

III. Training

Personnel required to work inside, or in support of those working inside CS/LE shall have training in the following areas:

A) hazards associated with CS/LE
B) emergency entry and egress procedures
C) respirators
D) first aid
E) lockout with tagout procedures
F) safety equipment
G) rescue procedures
H) permit system
I) work practices (see Section VI)

IV. Testing and Monitoring

Absolutely no CS/LE entry is to be initiated until appropriate initial testing has been conducted to assure the atmosphere in the CS/LE is safe. Monitoring shall be conducted for oxygen content, combustible gases/vapors, toxic contaminants and any other tests specified by the on-site health and safety officer. Monitoring of the CS/LE shall be done on a continuous basis while personnel are in the CS/LE enclosure.

Entry into CS/LE shall not be permitted, or evacuation of the CS/LE undertaken under the following conditions:

A) oxygen concentrations less than 19.5% (148 mm Hg*) or greater than 23.5% (178mm Hg*)

B) flammability measurements greater than 20% of the lower explosive limits (LEL) for Non-Hot Work Operations

* Based on Atmospheric Pressure of 760 mm Hg (Sea Level)

C) flammability measurements greater than 10% of the LEL for Hot Work Operations

D) toxicity measurements indicating an IDLH atmosphere's existence in the CS/LE.

Whenever any of the no entry permitted/evacuation conditions occur, the volumes of mechanical ventilation supplied to the space shall be increased and maintained at the increased levels. Entry or re-entry will be permitted when: 1) oxygen levels are measured greater than 19.5% and less than 23.5%; 2) LEL measurements fall below 10%; and 3) an IDLH atmospheric condition no longer exists.

Initial atmospheric samples shall be drawn while outside the CS/LE at least at the following locations:

1) Outside the entry points(s)
2) Immediately inside the entry point(s)
3) At least every four feet in depth of the CS/LE to the surface of the floor or any remaining residues.

All initial monitoring results will be recorded on the entry permit.

V. Protective Equipment and Clothing

The entry permit will specify the level of protection to be used for the CS/LE entry. In most instances, the level of protection will be level B or greater. Under no conditions will the level of protection be less than level C.

Additional safety equipment in the form of safety belts, body harness, or wrist type harnesses with life lines shall be provided and used for all CS/LE entries. Lifelines shall be attached to extraction devices outside the CS/LE so that non entry rescues may be effected.

Standby personnel shall be equipped with at least the same level of protection as the entry team but in no case shall that be less than level B.

Other safety equipment that may be utilized where appropriate include safety nets, life jackets, electrical insulations and barriers as the particular CS/LE warrants.

VI. Work Practices

As part of the pre-entry procedure, the on-site safety and health officer shall review the entry permit with all members of entry team and standby personnel as indicated in Section I.

A) Purging* and Ventilation

All CS/LE enclosures shall be subject to purging and continuous ventilation after initial atmospheric testing but prior to any actual entry. The only exception to this requirement is where entry is made solely to obtain samples of materials remaining in the CS/LE AND initial atmospheric testing indicates:

1. No oxygen deficiency or enrichment,
2. LEL measurements are less than 20%,
3. Toxicity measurement less than established standards (such as the OSHA PELs or ACGIH TLV's whichever is most stringent).

B) Isolation/Lockout and Tagging

Except for such CS/LE as manholes, sewers, tunnels where complete isolation is not physically possible, all CS/LE shall be completely isolated from all other systems by such means as double block and bleed, blanking or physical disconnection of all lines. All lines that have been subject to the isolation actions shall be tagged to identify the reason for blocking, blanking and/or disconnection.

*Purging is defined by this document as the means by which gases, vapors or other airborne contaminants are displaced from a CS/LE. Ventilation is one, but not the only means of purging a CS/LE.

The CS/LE shall be electrically isolated to prevent accidental activation of moving parts in the CS/LE or other electrical equipment serving the CS/LE. Electrical isolation shall be accomplished by lockout of circuit breakers and/or power disconnects in the open (OFF) position by key-type padlock. Each person entering the CS/LE shall have placed a lock on the circuit breaker/disconnect and shall maintain possession of the only key to the lock. Any circuit breaker/disconnect that is locked out, shall also be tagged to identify the reason for the lock out.

Mechanical isolation of moving parts shall be achieved by disconnecting linkages, or removal of chain or belt drives. Other moving mechanical parts shall be blocked in such a way as to preclude accidental rotation. Any mechanical isolation shall be tagged to identify the reason for the isolation.

C) Cleaning

Initial cleaning of any CS/LE shall be done from the outside if at all feasible. If initial atmospheric testing shows a flammable atmosphere at or above the upper explosive limit (UEL) in the CS/LE enclosure, it shall be inert gas purged prior to starting ventilation.

The cleaning process itself may create an additional potential for hazard in the CS/LE. Examples of such conditions include:

1) Excessive heat stress in the CS/LE if it is steam cleaned and not allowed to cool down, 2) build up of toxic materials if a chemical neutralization is used and ventilation is not maintained or adequate, 3) potential for fire and explosion in the CS/LE where the auto ignition temperature of the stored product in the CS/LE is 120% or less of the steam pressure and/or the steam hose nozzle is not bonded to the CS/LE during steam cleaning operations.

D) Equipment and Tools

All tools and other equipment for use in CS/LE shall be inspected for compliance with the following requirements:

1) Tools and equipment will be kept clean and in a good state of repair
2) All electrical equipment including portable tools, lighting, and power cords shall meet approvals in accordance with OSHA regulations found in 29CFR 1910 subpart S, including provisions for ground fault interruption protection and visual inspection of equipment for defects or damage.
3) Lighting used in CS/LE shall be of explosion proof design equipped with necessary guards and bearing Underwriters Laboratories or other appropriate approval listings.
4) Air activated tools shall be used where flammable liquids are present and shall be bonded to the CS/LE.
5) Compressed gas cylinders, except those that are part of SCBA or resuscitation equipment, shall never be permitted inside a CS/LE. Cylinders used to supply compressed gases to CS/LE shall be turned off at the cylinder valve when not in actual use, and the supply lines removed from the CS/LE.
6) Ladders, scaffolding and staging shall be adequately designed and secured and in conformance with OSHA regulations found in 29CFR 1910 subpart D.
7) Any equipment subject to use in CS/LE where flammable atmospheres may occur shall be listed as explosion proof or intrinsically safe by a recognized testing laboratory.

E. Recordkeeping

Copies of the entry permit will be maintained as an employee exposure record as required under 29CFR 1910.20.

Work Permit

EXPIRATION DATE: _____

CS/LE Operations

Location of CS/LE: _____

_____

Description of task: _____

_____

_____

Identified Hazards (see checklist): _____

_____

_____

Personnel Assigned

Name: _____ duties: _____

Name: _____ duties: _____

Name: _____ duties: _____

Name: _____ duties: _____

Name: _____ duties: _____

Special Equipment Required _____

_____

_____

Special Safety Requirements/Procedures _____

_____

_____

_____

_____

Initial Atmospheric Tests:

	AT ENTRY	INSIDE	DEPTHS 4'	8'	12'	16'	20'
oxygen levels	____	_____	_____				
combustible gas	____	_____	_____				
toxics _____	____	_____	_____				
_____	____	_____	_____				
_____	____	_____	_____				

Level of protection ____

Adequate P.P.E. Supply ____

Isolation Complete ____

Rescue Equipment ____

Ventilation Functional ____

Tools & Equipment Approved ____

Lighting & Elec. Approved ____

Communications ____

Permit Approved by: _____

on-site health & safety officer

Hazards Checklist

Flammable atmosphere (specify) _____

Toxic atmospheric (specify) _____

Oxygen deficiency

Ionizing radiation

Mechanical hazards (specify) _____

Respirators, protective clothing, gloves, boots equal to personnel assigned to CS/LE (additional) SCBA cylinders available)

All electrical circuits to CS/LE locked out and tagged

Drives to mechanical moving parts disabled and/or otherwise blocked and tagged

Lines into the CS/LE blanked, blocked, or disconnected and tagged

Harness with lifelines and extraction devices

Ventilation equipment, velocity measurement _____

Tools and electrical equipment approved for location and in good condition

Lighting of explosion prod designed and listed

Communication provided for

Atmospheric monitoring equipment for initial testing at continuous monitoring present and operational

ATMOSPHERIC MONITORING RESULTS

THIS EQUIPMENT HAS BEEN
REMOVED FROM SERVICE DUE
TO CONFINED SPACE WORK
AT _____

DO NOT OPERATE

REFERENCES

1. Criteria for a Recommended Standard... Working in Confined Spaces, DHEW (NIOSH) Publication Number 80-106. Cincinnati, U.S. Department of Health Education and Welfare, Public Health Service, National Institute for Occupational Safety and Health. 1979.

2. Limited Egress/Confined Spaces, Los Alamos, New Mexico, Los Alamos Scientific Laboratory. 1980.

3. Proposed Michigan State Confined Space Entry Standard, Part 90 Rule 408. Ann Arbor Michigan, Michigan Occupational Safety and Health Administration. 1984.

4. Standard Practice for Confined Area Entry, ASTM D4276-84, Philadelphia, PA, American Society for testing and materials, 1984

5. A Primer on Confined Area Entry, Malvern, Pennsylvania. Bio Marine Industries, Inc., 17pp.